HEALTH ASPECTS OF PESTICIDES

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OFFICE OF PESTICIDE PROGRAMS

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HEALTH ASPECTS OF PESTICIDES ABSTRACT BULLETIN is a monthly publication of the Technical Services Division of the Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides on humans. The publication represents a monthly review of more than 1150 domestic and foreign journals. Subjects and authors of abstracted articles are cross-referenced in an annual index issue. Reprint requests should be directed to the author of the complete article.

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73-1777. Rogers, B. L. (Univ. Maryland, College Park, MD 20742). **What's what with herbicides.** *Amer. Fruit Grower 93(4): 20, 52; 1973.*

Elimination of herbicides would be less disastrous to orchard operations than eliminating insecticides or fungicides, but several benefits would be lost; the cost of fertilizer would increase and fruit size and tree vigor could be affected. Mice, a major threat to apple orchards, are almost completely controlled by limiting vegetation beneath the trees. Dalapon, paraquat, terbacil, simazine, diphenamid, dinoseb, MSMA, and dichlobenil have been approved for use in both apple and peach orchards, ammate, diuron, and 2,4-D for apples, and trifluralin and non-selective weed oil for peaches. Amitrole, a valuable herbicide, has been removed from the registered list by the Environmental Protection Agency. Registration is now more difficult because legislation requires specific labeling of each chemical for each crop. The cost of development of a new pesticide can exceed $10 million. Compounds must be registered for crops other than fruit to balance these costs.

73-1778. McDuffie, B. (Lab. Trace Methods Environ. Analysis, Dept. Chem., State Univ. New York, Binghamton, NY). **Toxic substances in food: telling it like it is.** *Ass. Food Drug Off. US Quart. Bull. 36(3): 151-159; 1972.*

Toxic substances in food, including pesticides, arsenic, and mercury, are expected to increase with population growth and increased production of toxic substances. A correlation has been demonstrated between dietary intake of tuna and swordfish and mercury blood and urine levels in humans, and many other studies have pointed to food as a source of environmental contaminants. The FDA should consider labeling foods with the analytical data regarding contaminants as well as carbohydrate content and other analytical results. If levels of a particular compound are above the "harmful" level, the product would be withdrawn from the market. Products containing insignificant amounts would not require data on the label and those in the intermediate region would have sufficient information to allow the consumer to control his intake of the contaminant. The cost of such a procedure would be low, about $10 for mercury in tuna fish per code number, or much less than a penny a can.

73-1779. Kerr, E. E. (Region. Vet., Food and Drug Admin., San Francisco, CA). **Residues—facts or fallacies.** *Ass. Food Drug Off. US Quart. Bull. 36(3): 186-191; 1972.*

Adverse publicity concerning feed additives and contaminants, based more on theory than on fact, has plagued the FDA and the USDA recently. The livestock producer may determine whether or not these additives are available to him in the future by the way in which he uses them. In the instances in which residues such as arsenic have been reported in meat and poultry, the cause was generally improper use of the additive. Organic pesticide residues are more persistent and more difficult to trace. To help correct the residue problem the meat industry should not request the delivery of animals which have not been withdrawn from medicated feed to complete the day's kill. Carcasses of animals suspected of having been treated with drugs should be retained until wholesomeness can be established.

73-1780. Ishii, S.; Nishizawa, Y. (Sumitomo Chemical Industries, Kitahama Higashi, Osaka, Japan). **[The development of new pesticides (agricultural chemicals).]** *Baioteku (Biotech) 4(3): 216-221; 1973.* (Japanese)

General trends in the use and development of agricultural chemicals are discussed. The statistics show that the amount of agricultural chemicals used in Japan per hectare is the highest in the world, seven times greater than the amount used in the United States and 5.8 times the total usage in Europe with herbicides becoming more popular. The total amount of Sumithion (fenitrothion) production is 6000 t/year, of which 2000 tons are used domestically. At present, the average effective concentration of any pesticide is roughly 500 to 1000 ppm. In the future, more powerful pesticides should be developed to lower the concentration to 250 ppm to avoid pollution by sheer quantity. Farmers tend to overuse pesticides to secure 100% effectiveness, and mild pesticides used in large quantities pollute the environment more than limited usage of a stronger pesticide. The problem of accumulation and chronic toxicity can be avoided by the development of more effective pesticides and elimination of overuse.

73-1781. Pank, C. J. (Author address not given). **Silent spring—ten years after.** *BioDynamics 104: 5-17; 1972.*

Since Rachel Carson's *Silent Spring* aroused public concern over the misuse of chemicals in agriculture and other areas, many signs of progress can be seen in legislation and decisions concerning environmental problems. American agriculture continues to practice massive application of chemical fertilizers and pesticides which gradually destroy soil fertility, reduce the quality of foods produced, and add to the pollution of the environment. The Bio-Dynamic method of farming has failed to convert many farmers to its demonstrated, successful, gradual elimination of the use of antibiotics and reduction of chemical fertilizers and pesticides.

73-1782. Behrens, D. (Dechema, 6000 Frankfurt (Main) 97, Germany). **Environmental protection: challenge for chemical engineering.** *Chem. Eng. 9(271): 143-150; 1973.* (4 references)

Pesticides are among the most important products of the chemical industry to be considered regarding

environmental protection. These and other products as well as pollutant emissions from industry were surveyed by a Government Committee in Germany. The use of pesticides is expected to continue for a long time since production and storage of food is dependent on them. Successful alternatives such as sterilants, sexual attractants, and juvenile hormones are being developed, but are expensive and unavailable for some of the most important pests. Higher selectivity, lower toxicity to man and animals, metabolism, degradation in soil, water and atmosphere, and resistance are some aspects of chemical insecticides that must be investigated. Progress can only be made through costly, long-term research. The establishment of a Council for the Environment is recommended to study and develop guidelines for limitation of harmful influences on the environment, determine biological limiting values for emissions, establish research projects to clarify the prerequisites for guidelines and limiting values, publish these values, counsel authorities on technical questions, and set up an information system.

73-1783. York, Jr., E. T. (Inst. Food Agr. Sci., Univ. Florida, Lake Alfred, FL). **Ecology, the environment and man—a perspective.** *Citrus Ind. 51(11): 4-7; 1970.*

Measures being advocated by people writing on the subject of ecology are often regressive; the benefits of technological discoveries which have contributed to the advancement of civilization in recent decades are often denied. The case of DDT illustrates the flimsy scientific evidence which is being used as the basis for removal of an agent that has drastically improved the status of mankind. One of the major points of concern is the implication that DDT will destroy our source of oxygen through its toxicity to marine algae. In a study on which this concern was based, a saturation level of DDT in sea water had no effect on the five algae tested. While caution must be exercised in handling poisonous substances, decisions regarding their use should be based on a sound scientific evaluation of the benefits and risks.

73-1784. Grierson, W. (Univ. Florida, IFAS Agr. Res. Educ. Cent., Lake Alfred, FL 33850). **Chemicals in agriculture.** *Citrus Ind. 53(2): 9-11, 13-15; 1973.*

As in the case of a number of issues involving consumer safety, the hazards of the use of fungicides, coloring agents, and waxes in the citrus industry have been sensationalized and misrepresented in the press. Legislation which has resulted from pressure from uninformed activists generally calls for a total ban and provides no substitutes, and those involved in finding safer agricultural chemicals are leaving the field because of decreasing profits and harassment. Any chemical is unsafe if consumed in too great a quantity, while proper use of many so-called "hazardous" chemicals can provide a safe level. The citrus industry needs a Long Range Planning Committee to handle matters not already considered by government, the university, or industry such as plans to cope with a sudden cancellation of all fungicides or how to convey critical information to the consumer. The food and agricultural industries must utilize interested and responsible channels like food editors for heading off prejudices and half-truths before they become distorted.

73-1785. Metcalf, R. L. (Dept. Zool., Univ. Illinois, Urbana, IL). **DDT substitutes.** *Crit. Rev. Environ. Contr. 3(1): 25-59; 1972.* (110 references)

Although DDT has had a tremendous impact on the health of world populations through its excellent control of vector-borne diseases and agricultural pests, the development of resistance by a number of insects and accumulation in the environment have stimulated research for substitutes. Methoxychlor is one of the most promising analogs of DDT since it has very low mammalian toxicity, does not accumulate in body tissue, is persistent on non-biological surfaces, and effective against DDT-resistant insects. A number of molecular modifications have eliminated the susceptibility of DDT to dehydrochlorination, the basis of resistance, but none of the compounds have all of the characteristics desired. Introduction of groups such as $p$$CH_3O$- to serve as biodegradable handles for multifunction oxidases can increase biodegradability without affecting desired persistence. The cyclodienes have been used extensively as substitutes for DDT, but generally have a greater mammalian toxicity, and resistance to them has developed rapidly. Of the organophosphates developed as insecticides, malathion is one of the safest but is more of an acute threat to human health than DDT. Both the organophosphates and carbamates are not persistent in soil and do not accumulate in body fat. The most promising DDT-substitutes that have come out of a WHO evaluation program are malathion, carbaryl, propoxur, fenitrothion, dicapthon, and bromophos. Even though these offer marked advantages over DDT, their cost will prohibit their use in some of the developing nations.

73-1786. Waldichuk, M. (Fish. Res. Board Canada, Pacific Environ. Inst., W. Vancouver, B.C., Canada). **Trends in methodology for evaluation of effects of pollutants on marine organisms and ecosystems.** *Crit. Rev. Environ. Contr. 3(2): 167-211; 1973.* (378 references)

Problems related to the biological and ecological study of pollution in the marine environment are examined. Objectives include: quantitative evaluation of effects of pollutants on different species of aquatic organisms, movement of the pollutant through the food chain, and ultimate site of disposal in the marine environment. The laboratory approach utilizes chemical analysis, toxicity tests, behavior response studies, and biochemical studies. Field investigations are getting away

from the short-term, obvious effects and examining more subtle effects on the ecosystem. Certain species which concentrate DDT, mercury, and other pollutants are being proposed as pollution indicators. Although basic methodology for pollution studies in the marine environment has not changed substantially in the last 10 years, many techniques developed by NASA and other efforts have advanced quality and quantity of data that can be gathered and evaluated. Models are available for simulating the behavior of the marine environment. However, a systems approach using a multidisciplinary team is urgently needed for work on coastal ecosystems, which are the most productive and the most often abused by man.

73-1787. Zimdahl, R. L.; Arvik, J. H. (Dept. Botany Plant Pathol., Colorado State Univ., Fort Collins, CO 80521). **Lead in soils and plants: a literature review.** *Crit. Rev. Environ. Contr. 3(2): 213-224; 1973.* (129 references)

Although lead is added to the environment through the use of the insecticide lead arsenate, the most important source at present is exhaust from automobiles. In soil lead concentrations decrease rapidly with increasing depth since leaching is slowed by formation of insoluble compounds and sorption by soils. Sorption is positively correlated with cation exchange capacity. Lead uptake in plants is principally in the roots, and levels in the edible parts of crops are on the order of a few hundredths of a ppm. Uptake is enhanced by low soil pH, and liming of the soil can reduce uptake. The effect of lead on plant growth is expected to be particularly severe when phosphorus is limited.

73-1788. Richardson, J. W. (Dept. Agr. Econ., Oklahoma State Univ., Stillwater, OK). **Interrelationships of pesticide restriction, environmental quality, and costs to society.** *Curr. Farm Econ. 45(4): 5-8; 1972.* (3 references)

If agricultural pesticides were restricted to 5% of the average use in 1965-1969, the consumer's expenditure for food would increase 12% the first year, 14% the second year, and 7% in the seventh year over the 1965-1969 base level since there are no substitutes for pesticides in the immediate future. Decreased production would cause a decrease in exported food and starvation of dependent populations. Although wildlife would benefit from a reduction in pollution by pesticide residues, sedimentation and loss of habitat resulting from use of more land to provide the same amount of food would cancel this benefit. More information is needed on the environmental effects of restricting pesticides so that an optimal level of pesticide use can be established.

73-1789. Milhaud, G. (Pharm. Toxicol., Ecole Nat. Vet., Alfort, France). **Evaluation de la toxicite a long terme des polluants chimiques. [Evaluation of the long-term toxicity of chemical pollutants.]** *Econ. Med. Anim. 13(6): 315-321; 1972.* (French)

Guidelines for the long-term toxicity tests for air pollutants, drugs, and pesticides are outlined. Acceptable daily intake values should be determined for pesticides which persist in vegetable and animal food products and form residues. The acceptable daily intake is determined by dividing by 100 the maximum ineffective dose as determined in a 2-year experiment for the most susceptible animal species. While conducting the animal tests, age and nutritional status-dependent variations in the susceptibility of animals should be taken into account. The entire life span, i.e., two years for rats, and about 18 months for mice, should be covered by the toxicity test.

73-1790. Custot, F. (Lab. Cooperatif d'Analyse et de Recherches, France). **Quelques donnees actuelles concernant la pollution alimentaire. [Some recent data on food contamination.]** *Econ. Med. Anim. 13(6): 323-330; 1972.* (France)

General problems of food contamination with pesticides, antibiotics, and food additives are reviewed with special regard to the situation in France. While there are specifications on the permissible doses of pesticides to be used in agriculture and on the time lapses between pesticide application and harvesting, no maximum allowable residue concentrations in the resulting food products have as yet been determined. The contamination of milk and milk products with organochlorine pesticides may be due to either spraying stables or to pesticide-treated animal feed, as in the case of heptachlor epoxide.

73-1791. Clement, R. C. (Nat. Audubon Soc., New York, NY). **The pesticides controversy.** *Environ. Affairs 11(3): 445-468; 1972.* (25 references)

The anti-anti DDT reaction has been articulated by Thomas Jukes and four others whose distorted, unscientific observations have received widespread publicity through the popular press. They have either chosen to omit data collected on bird-pesticide interactions, which are the most revealing in terms of wildlife, or incompetently analyzed ornithological data. Historically, those who support the pesticide status quo are favored by the law which generally protects the producer rather than the consumer. In agriculture it is claimed that a restriction of pesticides will bring the elimination of all agricultural chemicals and with it a movement to the ghettos by small farmers who can no longer make a profit. This is a fallacy and the introduction of pesticides has certainly contributed to the already tremendous migration of the rural population to the cities. The use of DDT in malaria control is now threatened not by a ban on its agricultural uses but by its continued use in agriculture in less developed nations. The World Health Organiza-

tion has expressed concern over the growing resistance of malaria vectors that has resulted from widespread use of the chemical in agriculture.

73-1792. McCaull, J. (Author address not given). **Assault on a lake.** *Environment 14(7): 33-39; 1972.* (17 references)

The history of persistent man-made pollutants like pesticides in Lake Michigan reveals the many ways in which nature introduces these wastes into living systems; the inability of present water pollution control technology to cope with recognized and future problems produced by man's activities is also shown. Pesticide contamination became serious before it was officially recognized, and such a situation is anticipated in the case of contamination by radioactive wastes from nuclear power plants. At a time when DDT was barely detectable in the waters of Lake Michigan, it had already been concentrated to detrimental levels in fish, resulting in the withdrawal of commercial salmon and a reduced capacity for breeding in the fish. Although the use of DDT in agriculture has been curtailed, the reservoir already formed makes a reduction in the build-up in fish unlikely in the near future. The build-up of dieldrin in the wool of sheep, which after processing eventually contaminates invertebrates in the river mouths, illustrates another environmental pool which cannot be eliminated quickly. The levels of polychlorinated biphenyls and phthalates are also increasing, and long-term effects of these compounds have not been thoroughly evaluated.

73-1793. Anonymous. **EPA to set re-entry times.** *Farm Chem. 136(4): 22, 24; 1973.*

The Environmental Protection Agency (EPA) will soon publish a Pre-Harvest Time Interval Schedule of re-entry times in the Federal Register. During the 60 days that follow, the EPA wants as much comment as possible. Minimum intervals within which workers will be allowed to return to harvest crops after spraying are: class 1 (highly toxic), 3 days; class 2 (moderately toxic), 2 days; class 3 (slightly toxic), 2 days; class 4 (low toxicity), no delay. Subclasses under class 1 will have re-entry times of 5 days or $>$ 5 days. Intervals will vary for the same chemical with different crops. If EPA does not act, a Department of Labor agency (OSHA) will put proposed standards on record. OSHA standards also consider the climate of an area. Not enough scientific data is available to properly establish national standards.

73-1794. Meister, R. L. (Ed.) (Willoughby, OH 44094). **1973 Farm Chemicals Handbook.** *Meister Publishing Co., Willoughby, Ohio, 1973, 268 p.*

Farm Chemicals Handbook is published annually by *Farm Chemicals* magazine as a directory and reference primarily for the fertilizer and pesticide industries. The handbook includes sections entitled: dictionary of plant foods; application equipment specifications guide; the pesticide dictionary; buyers' guide; and addresses of farm chemical manufacturers and suppliers. The pesticide dictionary lists all pesticidal compounds commercially available in the U.S. today, as well as many compounds available internationally. Technical descriptions of the materials and the names of principal basic producers as well as some chemical formulas are included. Common and chemical names are cross-referenced to trade names wherever possible. Definitions of some terms relating to pesticides and their use are also included in the pesticide dictionary.

73-1795. Anonymous. **Herbicide combinations. How safe are they?** *Farm Technol./Agri-Fieldman 29(2): 124; 1973.*

Washington has handled its increasing requests for state approval of herbicide uses not registered by the Environmental Protection Agency (EPA) with the help of the USDA and the State University. The procedure involves consideration if use is necessary and whether a registered pesticide will suffice, establishment of a residue tolerance if it is a food use, and assuring that the use does not present an unreasonable hazard to the environment or the public. Some of the safeguards found in individual herbicides and prepackaged mixes are not always found with herbicides mixed in the tank. An unwarranted risk is taken if mixtures of herbicides are used in which either or both of the compounds are not individually registered for use on the intended crop. Chemical incompatibility, physical incompatibility, and synergism or antagonism can be problems if herbicide mixtures have not been specifically tested.

73-1796. Tweedy, B. G. (Dept. of Plant Pathol., Univ. of Missouri, Columbia, MO 65201). **Symposium on origin and fate of ethylenethiourea fungicides. Introduction.** *J. Agr. Food Chem. 21(3): 323; 1973.* (4 references)

In view of the importance and widespread use of the ethylenebisdithiocarbamate fungicides, a symposium on their metabolic fate in animals and in the environment was presented at the 164th National Meeting of the American Chemical Society in New York City in August, 1972. These fungicides are degraded to a number of compounds, including ethylene thiourea (ETU). ETU has also been found as a contaminant in the formulated products, and is formed in greater quantities when the fungicides are stored under high temperature and humidity. The effects of ETU on the thyroid glands of mammals suggest that ETU residues on food may be hazardous. The symposium was intended to present the latest information on the ETU problem. (Author abstract reprinted by permission of the American Chemical Society, abridged)

73-1797. Heck, W. W.; Taylor, O. C.; Heggestad, H. E. (U.S. Dept. Agr., Agr. Res. Serv., Raleigh, NC). **Air pollution research needs: herbaceous and ornamental plants and agriculturally generated pollutants.** *J. Air Pollut. Contr. Ass. 23(4): 257-266; 1973.* (68 references)

In conjunction with a survey of research needed on the effects of air pollutants on plants, a brief review is presented of agricultural chemicals as air pollutants. Evidence of injury to nontarget plants from volatilization or drift of pesticides is limited because of the inadequate technology for monitoring these compounds in air. Studies on herbicides do reveal greater loss from sandy and loam soils than from clay soils and increased volatilization with increased moisture and temperature. Injury from herbicide vapors can often be distinguished from injury caused by root uptake. Concentration of herbicide and species and stage of growth of the plant determine the severity of damage. Indirect effects such as reduction of predators or parasites of certain pests result from the use of some insecticides. Significant levels of organochlorines have been measured in the atmosphere four feet above ground three weeks after application. Many studies illustrate the aerial transport of pesticides. Future research is needed in the areas of improving technology for monitoring pesticides in air, developing means of reducing volatilization, determining effects of airborne chemicals on nontarget organisms, and establishing alternative methods of pest control.

73-1798. Tschirley, F. H. (Office of the Secretary, U.S. Dept of Agr., Washington, DC 20250). **Pesticides. Relation to environmental quality.** *J. Amer. Med. Ass. 224(8): 1157-1159; 1973.*

The manner and degree of use of pesticides, rather than their inherent toxicity, determine the effect of these compounds on the environment. Transport and persistence are also important considerations, as demonstrated by the difference in distribution of DDT, which is not degraded rapidly, and its analog methoxychlor. Although the magnitude of the effects is being questioned, DDT has adversely affected some wildlife. The cancellation of most of its uses has promoted the distribution of methyl parathion, which is much more toxic to man and kills more beneficial insects. Though some misuse of pesticides has occurred, no evidence of severe ecological damage or unreasonable residues in food has been presented. Research is being intensified to find better integrated methods of controlling pests, but chemical pesticides will continue to be needed. Breeding for resistant crops and introduction of predators and parasites have been successful alternatives,but the task of managing the 20,000 species of pests by these techniques would be enormous. The use of pathogens must be carefully considered since undesirable mutations could be dangerous. Chemical growth modifiers have promise, but must be tested for toxicity and environmental safety.

73-1799. Ishii, K. (Nippon Soda Co., Ltd., Chiyoda, Tokyo, Japan). **Development and alternation of acaricides in Japan.** *Jap. Pestic. Inform. 15: 17-23; 1973.*

As the demand for pesticides has increased with increasing fruit production in Japan, the number of commercial acaricides has more than doubled (1962 to 1971). Rotational use of these acaricides has been an accepted measure for preventing the rapid development of resistance which is a serious problem in mite control, but new products cannot be expected to appear as quickly now that a 2-yr chronic toxicity study is required. More care must be exercised in application programs in consideration of this problem. Since the introduction of modern insecticides like DDT, which brought an increase in phytophagous mites, Japan has experimented with numerous types of compounds and combinations and by 1971 acaricides accounted for about 13.8% of all insecticides used.

73-1800. Katz, M.; LeGore, R. S.; Weitkamp, K.; Cummin, J. M.; Anderson, D.; May, D. R. (Univ. Washington, Seattle, WA). **Effects on freshwater fish.** *J. Water Pollut. Contr. Fed. 44(6): 1226-1250; 1972.* (254 references)

Literature on the effects of pesticides and herbicides and other water pollutants on freshwater fish was reviewed. Several reviews have been published on the ecological effects of pesticides in water. An international study of organochlorine residues was conducted by 17 laboratories. In a national monitoring program, DDT and dieldrin were found in most fish samples. Static bioassays indicated that on estuarine fish the descending order of toxicity of insecticides was endrin, DDT, dieldrin, aldrin, dioxathion, heptachlor, lindane, methoxychlor, phosdrin, malathion, dichlorvos, and methyl parathion. Duration of exposure, concentrations of chemicals, temperature, salinity, and pH affected pesticide mortalities. In a model ecosystem DDT was concentrated 10,000 to 100,000-fold in mosquito larvae, snails, and fish while methoxychlor was readily metabolized. The majority of the work on pesticides in estuarine waters involved acute toxicity studies. Two common herbicides, picloram and 2,4-D, had low toxicity to fish. The herbicides are generally less persistent than organochlorine insecticides. Uptake and toxicity have been studied rather extensively.

73-1801. Kennedy, M. V.; Stojanovic, B. J.; Shuman, Jr., F. L. (Mississippi Agr. Forest. Exp. Sta., State College, MS 39762). **Chemical and thermal methods of waste pesticide disposal.** *Miss. Farm Res. 35(11): 5; 1972.*

Results of an investigation of the chemical and thermal degradation of 20 compounds representing various types of pesticides in formulation indicated that the most practical method of decontamination is incineration. All 20 of the compounds were decomposed

completely by exposure to a temperature of 900° C. Provisions would have to be made for trapping and proper disposal of toxic gases formed and for disposal of toxic residues in the ash. Research is being carried out to produce recommendations for the design and operation of a disposal center. Single chemicals investigated were not satisfactory for degradation of all 20 of the formulations. Sodium biphenyl reagent, prepared by mixing and heating metallic sodium, anhydrous toluene, and the dimethyl ether of ethylene glycol, provided 80 to 99% degradation of the five pesticides tested, but is unstable. Metallic sodium and liquid ammonia appeared to be useful although the mixture is hazardous to handle.

73-1802. Stein, Jr., H. S. (Crane Pest Control, San Francisco, CA). **We're part of this picture.** *Pest Contr. 41(1): 11-12; 1973.*

Pest control is compatible with concern for the environment and is but an application of a concept of conservation. The goal is to sustain a stable, self-perpetuating eco-system that will support the existence and relative comfort of man, not by destroying entire species, but by providing an immediate environment for man that is not endangered by them. Experimentation is not the exclusive tool of the industry, and recent trends indicate that members of the National Pest Control Association are aware of their responsibilities for the safe and intelligent use of chemicals used in their activities.

73-1803. Morrill, Jr., A. (Honolulu, Hawaii). **Since "Since Silent Spring."** *Proc. Hawaii. Entomol. Soc. 21(1): 97-103; 1971.*

The public has no way of knowing the state of pesticide use or of deciding from the emotional, unsupported allegations whether or not it is endangering the environment. If pesticide use were to be banned, the present alternatives such as chemosterilants and radiosterilants could not provide the necessary control and could present other environmental problems. Biological controls such as the introduction of predators and parasites have been developed and used successfully in Hawaii. These successes, coupled with a great interest in preserving the delicately balanced environment of Hawaii, have influenced the military pest control program greatly. In the wide variety of control problems handled the consequences generally are considered; methods are aimed at the target species and selected on the basis of minimum impact on the environment. Spraying of planes and strengthening of quarantine procedures is done routinely in the military to prevent importation of pests. Certification, which is obtained after completion of an examination and an on-the-job demonstration of proficiency, is required of all persons handling pesticides.

73-1804. Bramble, W. C.; Byrnes, W. R. (Dept. Forest. Conserv., Purdue Univ., Lafayette, IN). **A long-term ecological study of game food and cover on a sprayed utility right-of-way.** *Purdue Univ. Agr. Exp. Sta. Res. Bull. 885: 1-20; 1972.* (11 references)

In a 19 year study on the effects of various herbicide treatments applied 1-3 years after clearance of a power company right-of-way, broadcast sprays of ammonium sulfamate and 2,4-D plus 2,4,5-T esters had the most drastic effects, reducing low plant cover to 10% during the first year after application and causing a shift in composition to fireweed and sedge-grass communities. These communities eventually reverted to the Bracken-Sedge-Herb-Blueberry community found in the control areas with the addition of sweetfern. Semi-basal spray of emulsifiable acids of 2,4-D plus 2,4,5-T reduced plant cover to 25% in the first year and resulted in a reduction in blueberries and an invasion of fireweed. Ultimately, the Bracken-Sedge-Herb-Blueberry community was restored with sweetfern as a major added component. Herbs commonly found in the forest as well as golden rod and sheep-sorrel developed on the right-of-way and provided highly nutritious food for wildlife. Heavy use of the area by white-tailed deer, wild turkeys, grouse, and rabbit indicated that attractive food and cover had been developed.

73-1805. Jukes, T. H. (Univ. California, Berkeley, CA). **DDT and free speech.** *Sciences 13(2): 3; 1973.*

In a Letter-to-the-Editor the negative bias of a letter entitled "Point of View" regarding DDT is considered. In the 1971 to 1972 hearings on DDT held by the Environmental Protection Agency, many of the most popular points of attack against DDT were shattered when unrepresentative sampling methods, withholding of testimony, and other evidence were presented. The Surgeon General and WHO, both involved in protecting public health, agree that DDT withdrawal would be a major tragedy, particularly in underdeveloped nations. Using the very reasoning suggested by the opponents of DDT, a good case for its continued use can be developed.

73-1806. Fremlin, J. H. (Dept. Phys., Univ. Birmingham, Birmingham, England). **Control DDT, don't ban it.** *Sciences 13(3): 3; 1973.*

A Letter-to-the-Editor, "Point of View," appeared to attack all scientists without distinction, indicating that some would do everything they could to block control of DDT. The author would probably not be able to cite any important scientist who would oppose a ban on the use of DDT sprayed from the air on crops in developed countries, especially those artificially limiting their total food production for economic reasons. An absolute ban on DDT, however, should not be enforced until a better product is developed for malaria control. This is an entirely different thing since DDT has saved

about 40 million lives and prevented an enormous number of debilitating illnesses.

73-1807. Stern, V. (Dept. Entomol., Univ. California, Riverside, CA 92502). **Now it's integrated pest control.** *World Farm. 15(1): 6-9; 1973.*

For economic and environmental reasons, integrated pest control programs should be considered fully in both immediate and long range farm management plants. During the early years of pesticide use, excessive application led to premature insect resistance, greater use of pesticides, eradication of beneficial insects, and environmental pollution. Recently, much evidence has been obtained suggesting that integrated control, which uses chemicals when needed along with crop sanitation, resistant varieties, host-free periods, and other biological and cultural techniques, has been successful for a wide variety of pests throughout the world. The determination of pest density which will cause economic damage is an essential part of an integrated program since control techniques such as chemical application are only applied when the economic injury level is reached.

73-1808. Bloch, D.; Kraul, I. (Game Biol. Sta., Kalo, Ronde, Denmark). **Residues of polychlorinated biphenyls (PCB) and organochlorine insecticides in eggs from mute swan (*Cygnus olor*) and pochard (*Aythya ferina*).** *Acta Vet. Scand. 13(4): 588-590; 1972.* (4 references)

Swans' eggs collected from two locations in Denmark contained *p,p'*-DDE at levels of 0.333 and 0.335 ppm fat weight and 1.02 and 3.34 ppm polychlorinated biphenyls (PCB), the higher PCB value reflecting the industrial pollution at one collection site. In addition, those eggs collected near the Baltic Sea contained unchanged DDT at a level of 0.151 ppm. Pochard which consume animal food supplemented by plants had eggs containing 2.015 and 40.7 ppm DDT and PCB, respectively, when sampled from the industrial site. The swan population has been increasing steadily since 1926, and no difference was observed in eggshell thickness between the two locations.

73-1809. Ogata, J. N.; Bevenue, A. (Dept. Agr. Biochem., Univ. Hawaii, Honolulu, HI 96822). **Chlorinated pesticide residues in honey.** *Bull. Environ. Contam. Toxicol. 9(3): 143-147; 1973.* (5 references)

Commercial honey of various labels (raw, natural, processed) from Hawaii, California, Iowa, and Mainland China was sampled and analyzed for organochlorines. All but 2 of the 21 samples contained chlorinated pesticide residues in the low ppb range. One contaminant resembled Aroclor 1254 and was found in a sample labeled "natural, comb pack." DDT, lindane, and DDE were present in this sample as well as in a number of the others, even if the source was a region of no known pesticide use. Dieldrin was present in only one of the samples. The two honeys containing no residues were labeled "pure" and "comb;" the latter was packed in a plastic bottle. Confirmation of the lindane, DDT, and DDE residues was made by mass spectrometry. From this study it is demonstrated that honey will probably meet the "zero" tolerance set by the Federal government in 10% of the commercially available products.

73-1810. Hagyard, S. B.; Brown, W. H.; Stull, J. W.; Whiting, F. M.; Kemberling, S. R. (Dept. Dairy Food Sci., Univ. Arizona, Tucson, AZ). **DDT and DDE content of human milk in Arizona.** *Bull. Environ. Contam. Toxicol. 9(3): 169-172; 1973.* (13 references)

All of the samples of breast milk taken from six lactating women contained chlorinated hydrocarbons, and generally the levels were higher than previously reported. The total DDT found in the milk ranged from less than twice the legal limit for organochlorines in cow's milk to over 10 times the limit. DDE was present in larger amounts than DDT and the amount of *o,p'*-DDT found was quite low. Although the differences were not significant, a greater residue was observed between 22 and 60 days post partum than during the period before or after that time.

73-1811. Ware, G. W.; Whitacre, D. M.; Dobie, J. B. (Dept. Entomol., Univ. Arizona, Tucson, AZ). **Apparent increase of DDTR residues in wafered hay.** *Bull. Environ. Contam. Toxicol. 9(3): 173-178; 1973.* (2 references)

DDE residues were measurably higher in compressed than in noncompressed alfalfa from the same bale, and residues increased with increasing wafering pressure to 10,000 psi and then declined. At 100°F, the 0 psi samples contained 0.27 ppm *p,p'*-DDT and 10,000 psi samples contained 0.309 ppm *p,p'*-DDE, and temperature and moisture content did not significantly affect the results. No explanation is available for the phenomenon, but it does appear to be a physical relationship between the insecticide molecule and plant cell which is altered by pressure and probably internal or frictional heat.

73-1812. Collins, R. D.; DeVries, D. M. (Shell Development Co., Biol. Sci. Res. Cent., Modesto, CA). **Air concentrations and food residues from use of Shell's No-Pest insecticide strip.** *Bull. Environ. Contam. Toxicol. 9(4): 227-233; 1973.* (1 reference)

No-Pest strips (dichlorvos) were placed in five centrally air-conditioned, five window air-conditioned, and five non-air-conditioned homes at a rate of 3-4 per home, with one strip in the kitchen and the others distributed at the discretion of the home owner. During the 96-day sampling period, air concentrations ranged from < 0.01 ppm to 0.11 ppm and were highest in homes having the least ventilation. Of the 174 meals collected during the test, 24 contained 0.02 ppm dichlorvos, 7 contained 0.03 ppm, and 5 contained 0.04 ppm. Of the meals containing dichlorvos residues, 18 were breakfasts and 18 were dinners. Lunches were not sampled.

73-1813. Wauchope, R. D.; Haque, R. (Dept. of Agr. Chem., Oregon State Univ., Corvallis, OR 97331). **Effects of pH, light, and temperature on carbaryl in aqueous media.** *Bull. Environ. Contam. Toxicol. 9(5): 257-260; 1973.* (11 references)

The kinetics of carbaryl hydrolysis in dilute NaOH solutions were investigated by the pH-stat method. Hydrolysis was conducted under a nitrogen atmosphere in a dark amber glass bottle immersed in a water bath, and a xenon arc lamp was used as a simulated solar radiation source. Arrhenius plots of the data were in good agreement with previous results, indicating little difference in carbaryl hydrolysis rate constants in NaOH solution vs. sea water. Carbaryl and 1-naphthol in weakly acidic solutions are stable in the dark and under laboratory light, and base hydrolysis of carbaryl in the dark results in formation of 1-naphthol as the only naphthyl product. However, basic 1-naphthol or hydrolyzed-carbaryl solutions turn yellow, then amber within 24 hours under laboratory light, indicating that the 1-naphthoxide ion is especially light-sensitive.

Extracts of xenon lamp-irradiated carbaryl solutions yielded mass spectra which could be assigned almost totally to 1-naphthol and lawsone, 2-hydroxy-1,4-naphthoquinone. Lawsone itself is also photosensitive, and basic carbaryl solutions kept under fluorescent laboratory light for several weeks gave 5-7 colored TLC spots besides 1-naphthol. None of these spots has been identified.

73-1814. Waldron, A. C. (Cooperative Extension Serv., Ohio State Univ., Columbus, OH). **Herbicide residues on strawberries: the effects of combinations of Dacthal and sesone.** *Bull. Environ. Contam. Toxicol. 9(5): 305-311; 1973.* (2 references)

Procedures were developed for determining residues of Dacthal (DCPA) and sesone on strawberries grown in plots treated with either of the pesticides or a combination of the two. Dacthal was extracted into benzene and the benzene concentrated to a small volume and transferred to a silica gel column. Then the material was eluted from the column with benzene, concentrated, and analyzed by electron capture gas chromatography. Since sesone was difficult to determine, 2,4-D, a metabolic product, was extracted into phosphotungstic-hydrochloric acid and then into chloroform. The chloroform extract was evaporated to dryness, dissolved in methanol and ether, and methylated with diazomethane. The methylated derivative was cleaned up on florisil and analyzed by GC. Dacthal residues ranged from 19 to 65 ppb and did not differ when treatment was 8 lb/A Dacthal or 8 lb/A Dacthal plus 3 lb/A sesone. 2,4-D was detected in only 3 out of 12 samples from sesone-treated plots, and all three were from plots treated with a combination.

73-1815. Huggenberger, F.; Letey, Jr., J.; Farmer, W. J. (Author address not given). **Adsorption and mobility of pesticides in soil.** *Calif. Agr. 27(2): 8-9; 1973.*

A mathematical model, developed to predict the distribution of pesticides in soil profiles, was evaluated by comparing predicted distribution and data obtained from laboratory experiments. The ratio (K) between pesticide molecules adsorbed and in solution was expected to increase with decreasing volumetric content, increasing organic content, and increasing bulk density. As water is applied to soil surfaces treated with pesticide, adsorbed molecules are desorbed and resorbed by soil at a lower level. From calculated results it was determined that the lower the effective adsorption coefficient, K, in the soil profile was, the broader the pesticide distribution would be. Infiltration experiments showed that, as predicted, increasing the effective adsorption coefficient from 7.8 for atrazine on a silt loam to 26.1 for diuron on the same soil tended to narrow the distribution curves, even through three times as much water was applied with diuron. Studies with lindane also confirmed theoretical predictions.

73-1816. Mankotia, M. S.; deMan, J. M. (Dept. Food Sci., Univ. Guelph, Guelph, Ontario, Canada). **Chlorinated hydrocarbon pesticides in some vegetable products.** *Can. Inst. Food Sci. Technol. J. 6(1): 6-8; 1973.* (12 references)

Twenty-four varieties of potatoes obtained from the Ontario Food Horticulture Research Station after the replacement of DDT with endosulfan and carbaryl as insecticides contained DDT residues ranging from 0.107 to 0.250 ppm in the first year and from 0.001 to 0.014 ppm two years later. The 94% average loss of DDT from potatoes during this period illustrates the fact that the half-life concept of pesticide residues is not always applicable. Unpeeled potatoes contained higher concentrations (0.02 to 0.05 ppm) than peeled ones (traces to 0.017 ppm). Of other vegetables analyzed at the same time, 1 of 3 imported canned carrots contained heptachlor at a level of 0.016 ppm and DDT at 0.327 ppm. Negligible amounts of pesticides were found in canned beets, onions, and potatoes. Peeled carrots and peeled or unpeeled apples did not contain appreciable amounts of organochlorines and ketchup and tomatoes contained traces of DDT, TDE, aldrin, and lindane.

73-1817. Bollag, J. M. (Dept. Agron., Pennsylvania State Univ., University Park, PA). **Biochemical transformation of pesticides by soil fungi.** *Crit. Rev. Microbiol. 2(1): 35-58; 1972.* (80 references)

A review of the literature indicates that little is known about fungal enzymes responsible for pesticide metabolism, but constitutive rather than inducible enzymes may play a major role in detoxification by fungi. Fungal oxidases such as tyrosinase and peroxidase can dechlorinate chlorinated phenols without ring fission, and the products are probably detoxified or removed by polymerization or other synthetic mechanisms. Phenylureas, triazines, and carbamates have been shown to be *N*-dealkylated. *O*-dealkylation, hydroxylation, ring cleavage, epoxidation, and β-oxidation have also been observed. Hydrolytic reactions may often be the only detoxication mechanism used by fungi. It is expected that more research on the oxidases would reveal transformation of many xenobiotic compounds. Reductive processes have also been important. Conjugation reactions have not been found extensively in fungi. Since available techniques for studying transformation of pesticides in a natural soil ecosystem are not satisfactory, more in vitro work should be pursued to indicate serious problems in the environment.

73-1818. Vrochinskiy, K. K.; Grib, I. V.; Grib, A. V. (All-Union Sci. Res. Inst. Hyg. Toxicol. Pestic., Polymers, Plastic Materials, Kiev, USSR). **Soderzhaniye khlororganicheskikh insektitsidov v vodnykh rasteniyakh. [Organochlorine insecticide residue levels in aquatic plants.]** *Gidrobiol. Zh. (Kiev) 6(6): 107-109; 1970.* (8 references) (Russian)

DDT and BHC residue levels were determined in *Lemna minor* L., *Spirodela polyrrhiza, Nymphaea alba* L., *Acorus calamus* L., and *Potamogeton pectinatus* L. from a river in an area which heavily used pesticides. The DDT and BHC levels were highest in *Nymphaea alba* L. with 11.5 and 4.4 mg/kg, respectively, while the corresponding values for the other species varied from 2 to 3.8 mg/kg and from 0.94 to 1.16 mg/kg. These exceeded the corresponding concentrations in water whose maxima were 1 mg of DDT and 4.4 mg of BHC per liter. The insecticides present in the water were absorbed by the plants chiefly through the root system and the leaves. Relationship between the residue levels in the plants during fall was evidenced. The benthic layer, incorporating insecticide-contaminated plant parts, contained 1.4 mg of DDT, DDE, and DDD (TDE), as well as 0.1 mg of BHC per kg.

73-1819. Cruickshank, P. A.; Jarrow, H. C. (Niagara Chem. Div., FMC Corp., Princeton, NJ 08540). **Ethylenethiourea degradation.** *J. Agr. Food Chem. 21(3): 333-335; 1973.* (11 references)

Ultraviolet irradiation (above 285 nm) of ethylenethiourea (ETU) on a solid substrate such as silica gel affords 2-imidazolidone as the major identifiable product. Several other products are formed, of which only bis(imidazolin-2-yl) sulfide has been identified. The 2-imidazolidone does not appear to undergo further degradation under these conditions. Decomposition of ETU is rapid, particularly in the presence of photosensitizers. Aqueous solutions of ETU undergo a very slow photolysis, which is markedly accelerated by sensitizers. ETU is stable to hydrolysis over the pH range 5.0 to 9.0 at 90°. (Author abstract reprinted by permission of the American Chemical Society)

73-1820. Ross, R. D.; Crosby, D. G.* (Dept. of Environ. Toxicol., Univ. of California, Davis, CA 95616). **Photolysis of ethylenethiourea.** *J. Agr. Food Chem. 21(3): 335-337; 1973.* (15 references)

Ethylenethiourea (ETU) in aqueous solution (0.5-50 ppm) was stable to sunlight. However, in the presence of dissolved oxygen and sensitizers such as acetone or riboflavin, it was rapidly photooxidized via ethyleneurea and glycine sulfate. ETU decomposition also occurred in boiled samples of agricultural drainage waters in sunlight but not in the dark, indicating that natural photosensitizers may play an important part in the environmental transformations of xenobiotics. (Author abstract reprinted by permission of the American Chemical Society)

73-1821. Bontoyan, W. R.; Looker, J. B. (Environ. Protect. Agency, Tech. Serv. Div., Res. Cent., Beltsville, MD 20705). **Degradation of commercial ethylene bisdithiocarbamate formulations to ethylenethiourea under elevated temperature and humidity.** *J. Agr. Food Chem. 21(3): 338-341; 1973.* (6 references)

The formation of ethylenethiourea (ETU) in 18 commercial formulations was studied under controlled laboratory conditions of elevated temperature and humidity. The study revealed a large increase of ETU in certain formulations after 0 to 39 days' storage and smaller increases in others. The rate and amount of increase is apparently dependent upon storage time and chemical decomposition of other degradation products. Methods of ETU analysis and identification are described. (Author abstract reprinted by permission of the American Chemical Society)

73-1822. Ivie, G. W.; Dorough, H. W.*; Cardona, R. A. (Dept. of Entomol., Univ. of Kentucky, Lexington, KY 40506). **Photodecomposition of the herbicide methazole.** *J. Agr. Food Chem. 21(3): 386-391; 1973.* (6 references)

Exposure of methazole [2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-5-dione] to ultraviolet light in methanol or to sunlight in water or as surface deposits resulted in loss of carbon dioxide from the oxidiazolidine ring with subsequent generation of several derivatives. Photoproducts identified include 3,4-dichloronitrobenzene, 1(3,4-dichlorophenyl)-3-methylurea, 1-(3,4-dichlorophenyl)urea, and two isomeric dichloro-1-methyl-2-benzimidazolinones. The methylurea and urea compounds were not produced in methanol, but 1-(3,4-dichlorophenyl)-3-methoxymethylurea was generated in rather large quantities. This compound degraded to the urea during workup of the photolysis mixture. The two isomeric dichloro-1-methyl-2-benzimidazolinone photoproducts were not phytotoxic to bean or tomato foliage, but were more toxic to mice than methazole when administered ip. (Author abstract reprinted by permission of the American Chemical Society)

73-1823. Joiner, R. L.; Baetcke, K. P. (Dept. of Biochem., Miss. Agr. and Forestry Exp. Sta., Mississippi State Univ., Mississippi State, MS 39762). **Parathion: persistence on cotton and identification of its photoalteration products.** *J. Agr. Food Chem. 21(3): 391-396; 1973.* (20 references)

Parathion was found to be at least seven times more persistent than previously reported on cotton. [^{14}C]Parathion was applied four times in three successive weeks to cotton in four environmental situations: environmental growth chamber; greenhouse; controlled-exposure field; and open field. After 28 days 11.2 to 15.4% of the total radioactivity applied was recovered by methanol extraction and was found to be 58 to 68% unchanged [^{14}C]parathion. There was a constant increase in photoalteration products, coupled with a consistent decrease in [^{14}C]parathion with time. Photoalteration products of parathion present included *S*-ethyl parathion, *S*-phenyl parathion, paraoxon, and *p*-nitro-

phenol. No previously unreported metabolites were found on cotton foliage. Procedures for the extraction, purification, identification, and quantitation of ^{14}C-radioactivity on cotton are discussed. (Author abstract reprinted by permission of the American Chemical Society)

73-1824. Dumas, T. (Res. Inst., Canada Agr., University Sub Post Office, London, Ontario N6A 3KO, Canada). **Inorganic and organic bromide residues in foodstuffs fumigated with methyl bromide and ethylene dibromide at low temperatures.** *J. Agr. Food Chem. 21(3): 433-436; 1973.* (12 references)

Fruit that was fumigated with methyl bromide over a range of temperatures had residues that diminished as the temperatures were lowered. When ethyl dibromide was used at a lower temperature (13°), the fumigant was highly adsorbed and retained for many days when stored at this temperature. Also, the inorganic bromide determination by ashing and bromate titration did not account for all the bromide resulting from ethylene dibromide present. Study of the distribution showed bromide in fruits was highest in the seed and skin and lowest in the pulp. (Author abstract reprinted by permission of the American Chemical Society)

73-1825. Johnson, Jr., J. C.; Bowman, M. C.; Leuck, D. B.; Knox, F. E. (Dept. of Anim. Sci., Coastal Plain Sta., Tifton, GA 31794). **Persistence of Dasanit in corn silage and effects of feeding dairy cows the treated silage.** *J. Dairy Sci. 56(6): 775-782; 1973.* (9 references)

When corn was sprayed in the field with Dasanit, (fensulfothion) at 0, 0.56, 1.12, and 2.24 kg per hectare and ensiled one day later, losses of Dasanit residues (Dasanit, Dasanit sulfone, Dasanit O-analog, and Dasanit 0-analog sulfone) from time of application through harvesting of the treatments were 14, 6, and 17% of the amount applied. After 76 days of ensiling, corn treated as above contained residues of 16.5, 27.8, and 50.6 parts per million which were equivalent to 73, 67, and 64% of the residues immediately after applying the .56, 1.12, and 2.24 kg treatments. Resulting silages were fed to 16 cows, four per treatment. Silage intakes, milk production, body weight gains, and blood cholinesterase activities of cows were severely and rapidly depressed by ingestion of Dasanit residues. These measures of performance were inversely related to amount of treatment, and recovery was slow. One cow fed silage produced from the 2.24 kg treatment died after ingesting Dasanit residues amounting to a total of 2.75 mg/kg body weight during the first seven days of experimental feeding. Dasanit and/or its metabolites were in milk, urine, and feces from cows fed silage from .56, 1.12, and 2.24 kg treatments. Total residues in milk, urine, and feces were .027, .036, and .020 parts per million or less. Milk, urine and feces were free of residues within one week after the cows were withdrawn from treated silage. (Author abstract by permission)

73-1826. Parker, B. L. (Agr. Exp. Sta., Univ. of Vermont, Burlington, VT). **Degradation of Gardona on standing and stored forage.** *J. Econ. Entomol. 66(2): 312-315; 1973.* (8 references)

Gardona (tetrachlorvinphos) was applied to field plots at 0.75, 0.50, and 0.25 lb active ingredient (AI) per acre. Residue samples were taken throughout the growing season. A field of hay treated at 0.75 lb AI/acre was cut, baled after suitable curing, and held in winter storage for degradation studies. The effect of three temperatures on the persistence of Gardona in stored hay was considered. Analyses were completed by gas chromatography. Forty-nine days after initial treatment Gardona residues in field treatments had disappeared. Forty-five percent of Gardona applied to hay that was immediately baled and stored was gone within 22 days. The decline thereafter was gradual. At 18 months residues were about 2 5 ppm. Gardona on hay stored at 72°F degraded faster than when stored at 45°F or at ambient temperatures. (Author abstract by permission)

73-1827. Hall, R. C.; Ballee, D. L.; Bennett, G. W.; Fahey, J. E. (Dept. of Entomol., Purdue Univ., West Lafayette, IN 47907). **Persistence and distribution of Gardona and dichlorvos in grain and grain products.** *J. Econ. Entomol. 66(2): 315-318; 1973.* (10 references)

Gardona was persistent on corn and wheat grain held in farm storage for eight months. Dichlorvos was rapdily lost from both grains, but it did exhibit some tendency to persist at trace residue levels. The corn milling products, bran, fine feed, and germ, contained 94% of the total Gardona residue and the only detectable dichlorvos residue. The wheat bran contained 67% of the dichlorvos residue and 90% of the Gardona residue. (Author abstract by permission)

73-1828. Saunders, J. L.; Getzin, L.W. (Western Washington Research and Extension Center. Puyallup, WA 98371). **Distribution of phorate and its oxidation analogues in Scots pine.** *J. Econ. Entomol. 66(2): 530-531; 1973.* (4 references)

Phorate, used for control of the pales weevil, was applied to beds of 3-year-old Scots pine seedlings during October, 1970, at Puyallup, Washington. Seedlings were lifted as bare root transplanting stock Feb. 23, 1971, and either stored at 4.4°C until analyzed or planted in central Wisconsin Christmas tree fields in May and then removed for analysis in August. Various tissues were analyzed by gas and thin-layer chromatography. Phorate and its sulfoxide and sulfone were recovered from most tissues of the seedlings in the spring analysis. Phorate sulfoxide was present in greatest amounts. Detectable levels of the toxicants were still present in most tissues in the fall six months after transplantation to untreated soils. Phorate residues were generally below the limit of detection (0.1 ppm) in all tissues except needles. New growth contained very little of the toxicants. The sul-

foxide and sulfone of phorate oxygen analog were detected in needle and bark extracts. Since phorate is rapidly oxidized to the dithioate in soil, the toxicants present in the trees represent composites of residues from plant absorption and metabolism within the tissues.

73-1829. Halfhill, J. E.; Maitlen, J. C. (Yakima Agr. Res. Lab., Agr.Res. Serv., U. S. Dept. of Agr., Yakima, WA 98902). **Residues of aldicarb in fresh and dried alfalfa.** *J. Econ. Entomol. 66(2): 557-558; 1973.* (5 references)

Test plots of 3-year-old alfalfa plants were treated with soil applications of a 10% aldicarb formulation at 2.1, 4.1, or 6.2 lb AI/acre on Apr. 3, 1968. Banded application was followed by tilling and irrigation. Samples were taken at various times after treatment. Half of each sample was frozen to await analysis, and the other half was dried for five days at 75-80°F. The combined residues of aldicarb, aldicarb sulfoxide, and aldicarb sulfone in fresh alfalfa at 12, 61, 82, 110, and 145 days posttreatment were 2.3, 3.2, 2.5, 2.4, and 0.7 ppm, respectively, for the 2.1 lb rate; 2.8, 2.4, 5.2, 4.1, and 2.0 ppm for the 4.1 lb rate; and 4.8, 3.4, 5.2, 4.0, and 2.2 ppm for the 6.2-lb rate. Recoveries averaged 92% from fresh samples and 99% from dried samples. Greenhouse-drying apparently reduced the total residues by an average of 32.7% in 12 of 15 samples.

73-1830. Krueger, H. R.; Lindquist, R. K.; Bauerle, W. L. (Ohio Agr. Res. and Dev., Center, Wooster, OH 44691). **Phorate and aldicarb in greenhouse lettuce: effect of CO_2 on residues.** *J. Econ. Entomol. 66(2): 573; 1973.* (3 references)

The effects of carbon dioxide enrichment on the metabolism of two commonly used systemic insecticides were examined. Leaves of aldicarb-treated lettuce plants grown in normal atmosphere contained 5.4 ppm aldicarb 24 days and 3.9 ppm 36 days after treatment; plants grown with CO_2 enrichment contained 6.3 ppm aldicarb 24 days and 3.5 ppm 36 days after treatment. Leaves of Phorate-treated normal-atmosphere plants contained 9 ppm phorate at 24 days and 11 ppm at 36 days; plants grown with CO_2 enrichment contained 3.8 ppm phorate at 24 days and 6.2 ppm at 36 days after treatment. Phorate stunted plant growth. The high residue level 36 days after treatment was not explained. The reported phorate values comprise phorate oxygen analog sulfoxide and sulfone since less than 2% of the GLC detector response corresponded to phorate or the other three metabolites investigated.

73-1831. Fair, J. G.; Collins, J. L.; Johnston, M. R.; Coffey, D. L. (Dept. Food Technol. Sci., Univ. Tennessee, Knoxville, TN 37901). **Levels of DDT isomers in turnip greens after blanching and thermal processing.** *J. Food Sci. 38(2): 189-191; 1973.* (17 references)

Intentionally high harvest residues of experimentally applied DDT on turnip greens were decreased both by washing and blanching and by thermal processing. TDE was the only residue which was slightly increased by thermal processing. No significant differences were observed when blanching was by steam or by water, in unlined or in enamel-lined kettles, or for three or five minutes. Levels of *o,p'*–DDT and *p,p'*-DDT were significantly lower in greens that had been water blanched and thermally processed than in greens that were steam blanched and thermally processed. Following thermal processing, levels of DDE and *o,p'*-DDT were significantly less on greens that had been water blanched three minutes in an enamel-lined kettle than on greens blanched three minutes in an unlined kettle. Enamel lining of the cans did not affect the residues.

73-1832. Sanford, K.; Burris, J.; Handleman, S. R. (Tissue Culture Sect., Lab. Biol., Nat. Cancer Inst., Bethesda, MD 20014). **Chemical analyses of sera influencing neoplastic transformation in vitro.** *J. Nat. Cancer Inst. 49(6): 1553-1561; 1972.* (37 references)

Gelding horse serum, which increased "spontaneous" neoplastic transformation of mouse cells in vitro, contained negligible amounts of organochlorine pesticides and heavy metals. Methoxychlor and dieldrin were not detected; levels of DDE, DDD (TDE), DDT, and BHC were < 0.005 ppm, and lead and mercury were present at 0.2 and 0.03 μM, respectively. Fetal bovine serum, which appears to inhibit neoplastic transformation, had much higher levels of hexosaminidase and galactosidase activities, which could not explain the difference in activity, and increased levels of several elements. The factors influencing neoplastic transformation were not destroyed by heating to 56° for 30 min.

73-1833. Tenney, M. W.; Higgins, T. E. (Univ. Notre Dame, Notre Dame, IN). **Effects on surface waters.** *J. Water Pollut. Contr. Fed. 44(6): 1204-1208; 1972.* (26 references)

Recent information on surface water quality in regard to pesticides and other pollutants is reviewed. No measurable degradation was observed over an eight week period in more than half of 12 organochlorines added to river water. All the carbamates tested and eight out of nine organophosphates were altered during the course of the experiment. Seepage of DDT after application to crops occurred in irrigation channels, and the chemical persisted in the water throughout the year. Factors affecting rates of adsorption and desorption of pesticides in water-soil systems have not been clarified. A massive fish kill in the Rhine stimulated extensive study of endosulfan in aquatic systems. Toxaphene could not be removed from sediments using water in the laboratory. In 18 lakes whose inflow consisted only of runoff from agricultural land measurable quantities of dieldrin, aldrin, and DDT were found.

73-1834. Young, R. H. F. (Univ. Hawaii, Honolulu, HI). **Effects on groundwater.** *J. Water Pollut. Contr. Fed. 44(6): 1208-1211; 1972.* (26 references)

Contamination of groundwater by pesticides has been reported several times. Sheep dip, discharged on land, was transported through a storage aquifer into a feeder stream of a lake. The subsequent depression of *Daphnia, Bosminia,* and chironomids resulting in algal blooms made the lake temporarily unsuitable as a water source. Backfill of a well with ground from a site previously used for flushing DDT and toxaphene sprayers resulted in a gradual increase in residues of these insecticides in the well water. Irrigation application rates and frequency and soil properties affected the leaching of herbicides and fertilizers into groundwater in Hawaii. Movement of other contaminants in soil has also been reported.

73-1835. Foess, G. W. (Univ. Massachusetts, Amherst, MA). **Aquatic sediments.** *J. Water Pollut. Contr. Fed. 44(6): 1211-1218; 1972.* (65 references)

A review of recent literature on aquatic sediments showed that the nature of the chemical and the sediment and the organic content of the sediment are determining factors in the fate of pesticides in the aquatic environment. Temperature, pH, salt concentration, or organic pollutant concentration in the water do not significantly affect pesticidal uptake and release. Toxaphene accumulated in sediment by direct sorption and by codeposition with algal blooms and other particulates. Since laboratory experiments showed that the sorption of toxaphene was irreversible, sediment could not be expected to be a source of toxaphene in the water.

73-1836. Sviridonov, M. G.; Novitskaya, V. Ye.; Boytina, N. M. (All-Union Sci. Res. Inst. Potato Processing, USSR). **Tekhnologicheskiye rezhimy, snizhayuschiye soderzhaniye pestitsidov v kartofele pri proizvodstve krupki. [Technological processes reducing the pesticide residue levels in potato in the production of dried mashed potato.]** *Konserv. Ovoshchesush. Prom. 28(1): 15-16; 1973.* (Russian)

The effects of different technological steps were studied in the production of dried mashed potato. Polychloropinene and trichlorfon residue levels were monitored using tubers previously soaked with polychloropinene and trichlorfon solutions for two days. While it was not possible to reduce the polychloropinene residue level by any of the technological steps tested, washing the tubers in alkaline solutions and steaming or boiling potato slices reduced the trichlorfon residue contents by 33% and by 21-50%, respectively. Trichlorfon residue levels could be reduced to below the maximum allowable concentration of 1 mg/kg by processes including alkaline washing, blanching, steam cooking, and drying. Polychloropinene-contaminated tubers should not be processed as foods.

73-1837. Siyali, D. S. (Div. Anal. Lab., P.O. Box 162, Lidcombe, New South Wales 2141, Australia). **Hexachlorobenzene and other organochloride pesticides in human blood.** *Med. J. Aust. 2(19): 1063-1066; 1972.* (13 references)

During a survey of 237 Australians, a marked difference was observed between levels of organochlorine pesticides in blood of people with and without known industrial exposure to pesticides. None of the participants showed any signs of intoxication. Dieldrin, aldrin, BHC, heptachlor and its epoxide, DDT and its metabolites, and hexachlorobenzene occurred generally in about the same ratio in both populations. Hexachlorobenzene, which was found in 97% of the subjects, has not been reported in human blood previously, possibly because of a failure to separate hexachlorobenzene and BHC or confusion between the two pesticides. The GC assay developed for this study utilized two separate polar and nonpolar solvents and provided adequate separation. The method was also rapid since the blood and hexane solvent were sonicated and the extract was directly applied to the GC column. Results of analysis of different foods indicate that food is a source of hexachlorobenzene and other common pesticides found in human blood.

73-1838. Anonymous. **Atmospheric distribution.** *Nature (London) 242(5396): 300; 1973.*

Vaporization, which may occur from falling spray particles and from plant, water, and soil surfaces, may contribute significantly to the distribution of pesticides in the atmosphere, particularly shortly after application. The interaction of wind speed, adsorption, crystal size, and temperature is complex, but winds can carry vapors over large distances and rain helps to deposit the vapors on the earth's surface. It has been estimated that the first mile of the atmosphere could contain up to 8,000 tons of organochlorine pesticides. Photochemical reactions may play an important part in the degradation of pesticides in the upper atmosphere. Another means of transport of pesticides is through the migration, particularly from Europe to Africa, and death of a number of birds. Since many species of insects occur in large numbers in the atmosphere, a regional international control program would be much more effective than the current crop spray programs.

73-1839. Pienaar, W. J.; Whitehead, V. B. (Fruit and Fruit Technol. Res. Inst., Stellenbosch, S. Africa). **Research note. Endosulfan residues on boysenberries.** *Phytophylactica 4(1): 27; 1972.* (2 references)

Boysenberries sprayed with endosulfan as a 50% wettable powder at 0.5 and 1.0 mg/500 l. contained residues of α plus β endosulfan of 4.7 and 5.6 ppm, respectively, three days after application. After 10 days the values were 1.4 and 1.4 ppm, lower than the South African tolerance of 2 ppm. The ratio of α endosulfan to

β endosulfan varied from 1.61 at 3 days to 0.53 at 14 days. Similarities in residues obtained with two different application rates could have been the results of differences in coverage and in the exposure of the berries to direct sunlight.

73-1840. Harris, C. R.; Thompson, A. T.; Tu; C. M. (Res. Inst., Canada Dept. Agr., London 72, Ontario, Canada). **Insecticides and the soil environment.** *Proc. Entomol. Soc. Ont. 102: 156-168; 1971.* (9 references)

Dasanit (fensulfothion), a relatively new and more active organophosphate insecticide, degrades in soil at a rate just slightly greater than that of aldrin (moderately persistent); one of the initial degradation products, the sulfone, is also insecticidal. In soil with low organic matter Dasanit levels dropped about 50% in 2-3 weeks, while biological activity remained the same for 10 weeks and then decreased rapidly. Turnips, one of the few crops monitored for this insecticide, contained no detectable levels of Dasanit and 1/10 the U.S. tolerance of 0.1 ppm of the sulfone in the roots and 0.012 ppm in the tops. Earthworm populations in plots treated at 3 lbs/acre Dasanit were significantly reduced (79%) after three weeks and had fully recovered after 52 weeks. Dasanit was also more toxic to beneficial arthropods in experimentally treated soil. No significant effects on soil microorganisms were observed. Although an insecticide is less residual it cannot be assumed that it will have less deleterious environmental effects.

73-1841. McGaughey, W. H. (U.S. Grain Marketing Res. Cent. Agr. Res. Serv., U. S. Dept. of Agr., Manhattan, KS 66502). **Malathion treatment of rough rice re-evaluated.** *Rice J. 75(10): 16-17; 1972.*

Rough rice held in a metal bin at 60% humidity and 15 to 30°C temperatures for three months contained residues < 8 ppm, the legal tolerance, whether 1.0, 1.5, or 2.0 pints of malathion/1000 bushels were applied. Hull residues dropped sharply initially, but required 7 to 11 months to reach the 8 ppm level. Residues on bran and milled rice were comparatively low just after treatment, increased sharply for three months, and then gradually declined. Levels on milled rice never reached the legal tolerance. Although infestation pressure was continuous in the warehouse, minimal infestation was found after 12 months.

73-1842. Vrochinskiy, K. K. (All-Union Sci. Res. Inst. Hyg. Toxicol., USSR). **K prognozirovaniyu dinamiki ostatkov fozalona v vode vodoyemov. [Predicting the phosalone residue dynamics in water reservoirs.]** *Ryb. Khoz. 48(2): 16-17; 1972.* (Russian)

In a model experiment to obtain data on the dynamics of the phosalone concentration reduction as a function of time phosalone residue concentrations were determined in pond water at different intervals after introduction of a single dose of 0.13-2 mg/l. Residue determination was done by thin-layer chromatography. The phosalone concentrations in pond water without aquatic plants and microorganisms were reduced to 59.1, 48.6, and 9.8% of the original concentration from levels of 0.13-1.8 mg/l. in 1, 3, and 4.5 through 11.5 days, respectively. Pond water contained no phosalone residues 26 days after introduction. The fractions of the original phosalone concentration of 0.15-2 mg/l. that were found 1, 4.5, and 11.5 days after introduction in the pond water containing aquatic plants and microorganisms were 17.4, 3.5, and 1.5% respectively. The residue determination data indicates that the phosalone residue dynamics in pond water with aquatic plants and microorganisms can be best described by an exponential curve for the first three days, and by a step curve for the later course of the residue concentration reduction. It is possible to predict phosalone residue dynamics in pond water for a concentration range of 0.13-2 mg/l.

73-1843. Parr, J. F.; Smith, S. (Soil Water Conservation Res. Div., Agr. Res. Serv., U.S. Dept. of Agr., Baton Rouge, LA). **Degradation of trifluralin under laboratory conditions and soil anaerobiosis.** *Soil. Sci. 115(1): 55-63; 1973.* (15 references)

The effects of light, volatilization, and soil microorganisms were investigated on the persistence of trifluralin under laboratory conditions. Recoveries of 85% were obtained after 30 days with concentrations of 0.1 and 1.0 ppm trifluralin maintained in the dark, while only 9 to 18% remained after six weeks when the same concentrations were exposed to light. The degradation products isolated indicated an aerobic pathway, and the rate of photodegradation was concentration dependent. Under anaerobic conditions in soil amended with alfalfa meal, only 15% remained after 5 days; autoclaved, amended soil exhibited little capacity to degrade trifluralin. Degradation was much less rapid in unamended soil. In an aerobic environment the extent of degradation was considerably less than in an anaerobic environment. Volatilization in these experiments was rapid at first and then decreased rapidly in the anaerobic system and became progressively slower in the aerobic system. Flooding the soil greatly retarded volatilization.

73-1844. Shearer, R. C.; Letey, J.; Farmer, W. J.; Klute, A. (National Parks Commission, Belair Nat. Park, Belair, South Australia 5052). **Lindane diffusion in soil.** *Soil Sci. Soc. Amer. Proc. 37(2): 189-193; 1973.* (10 references)

Vapor and "nonvapor" diffusion of lindane was measured in Gila silt loam at various soil-water contents. The apparent vapor diffusion coefficient (Dv') increased rapidly as water content increased to 4%. There was a gradual decrease in Dv' as water content increased from 4 to 20% and then a rapid decrease at water contents greater than 20%. The "nonvapor" apparent diffusion

coefficient (Ds′) also reached a maximum at 4% water content and declined at water contents between about 4 and 20%. Ds′ increased as water content was increased above 20%. Apparently, diffusion in the "nonvapor" phase occurs at the water-air and water-solid interface as well as in the water. The contribution of these pathways to the total transfer is dependent upon water content. It was assumed that the water-solid diffusion coefficient would be constant at water contents above 4%. The air-water interface diffusion was highest at 4% water content and decreased at higher water contents. Diffusion in water was essentially zero at water contents below 15% and increased with increasing water contents above this value. (Author abstract by permission)

73-1845. Bowman, B. T. (Res. Inst., Canada Dept. of Agr., London, Ontario, Canada). **The effect of saturating cations on the adsorption of Dasanit, *O,O*-diethyl *O*-[*p*-(methyl sulfinyl) phenyl] phosphorothioate, by montmorillonite suspensions.** *Soil Sci. Soc. Amer. Proc. 37(2): 200-207; 1973.* (48 references)

A study was conducted to examine the adsorptive behavior of Dasanit (fensulfothion) in montmorillonite suspensions as affected by saturating cations and the clay suspension concentration. Adsorption isotherms, similar to Type III or Class "S" isotherms, were constructed for 10 cation-saturated montmorillonites. Infrared spectroscopy was used to examine the relative polarities of the sulfoxide, sulfone, phosphoryl, and carbonyl groups as they occur in Dasanit, in some of its oxidation products, and in several other insecticides. Despite its polar nature, Dasanit did not appear to adsorb on the interlayer surfaces of montmorillonite. X-ray diffraction data for dry Dasanit-montmorillonite systems showed a maximum interlayer expansion of 2.7 A. Kinetic data showed that the adsorption process reached equilibrium in less than 15 min. The sequence of the upper linear segments of the 10 isotherms appeared to be related to valence, atomic weight, and coordinating habits of the saturating cations. The Fe-montmorillonite system adsorbed the most Dasanit. At a suspension concentration of 15 mg/ml, this system removed 99% of the Dasanit from solution. The maximum adsorption value obtained for Fe-montmorillonite was 0.354 mg/mg clay at a suspension concentration of 0.25 mg/ml. This value corresponded to approximately 4.8 Dasanit monolayers on the exterior clay surface. Desorption studies indicated that those clays with the greatest adsorption capacity exhibited the least desorption tendency. The decreasing order of desorption was Na– > Ca– > Al– > Cu–montmorillonite. (Author abstract by permission)

73-1846. Huggenberger, F.; Letey, J.; Farmer, W. J. (Dept. of Soil Sci., Univ. of California, Riverside, CA 92502). **Effect of two nonionic surfactants on adsorption and mobility of selected pesticides in a soil-system.** *Soil Sci. Soc. Amer. Proc. 37(2): 215-219; 1973.* (14 references)

The effect of two nonionic surfactants on the adsorption and mobility of lindane, diuron, and atrazine in soil columns was studied. A wide range of surfactant concentrations was used in this study. Adsorption of the pesticides by soil from a surfactant solution was inversely related to the leaching of the pesticides through the soil in presence of the surfactants. Low concentrations of both surfactants did not influence adsorption and mobility of the pesticides. A marked increase in the adsorption and reduction in the mobility of the pesticides was observed with 500 ppm Aqua Gro and 2,000 ppm Soil Penetrant. At concentrations of 5,000 ppm and 10,000 ppm, both surfactants decreased the adsorption and increased the mobility of lindane and diuron, but did not influence the adsorption and mobility of atrazine. An attempt was made to explain the mechanisms by which the two surfactants influence adsorption and mobility of the pesticides using the concept of micelle formation and critical micelle concentration. (Author abstract by permission)

73-1847. Woolson, E. A.; Axley, J. H.; Kearney, P. C. (Agr. Environ. Qual. Inst., Agr. Res. Cent., Agr. Res. Serv., U. S. Dept. of Agr., Beltsville, MD 20705). **The chemistry and phytotoxicity of arsenic in soils: II. Effects of time and phosphorus.** *Soil. Sci. Soc. Amer. Proc. 37(2): 254-259; 1973.* (26 references)

Arsenate from sodium arsenate changes to less soluble compounds in soils with time. To study these changes, the arsenic soluble in 1 *N* NH_4Cl, 0.5*N* NH_4F, 0.1*N* NaOH, and 0.5*N* H_2SO_4 solutions was determined. These dissolved arsenates were designated as WS-As (water soluble), Al-As, Fe-As, or Ca-As, respectively. The percent of WS-As present was proportional to As added and inversely proportional to time, and to the Fe and Al content. Fe-As was the predominant form of As in Hagerstown silty clay loam while Al-As predominated in Lakeland loamy sand. Growth of corn (*Zea mays*) increased with increase in time of As incubation in the soil before planting. Arsenic phytotoxity and As in the plant were altered by P additions. Arsenic residues in the Lakeland soil became more phytotoxic, while residues in the Hagerstown soil became less phytotoxic with P additions. This plant response was related to the availability of As and P in these soils. Leaching with 0.05*M* KH_2PO_4 removed 77% of the total As from a contaminated Dunkirk fine sand. The distribution of the forms of As in this soil changed during leaching. (Author abstract by permission)

73-1848. Braastad, J. O.; Edberg, H.; Nilsson, I. (Dept. Inorganic Phys. Chem., Fac. Pharm., Univ. Uppsala, Box 6804, S-113 86 Stockholm, Sweden). **Hydrolysis of thiocarbamates and trapping of a reactive intermediate in the hydrolysis of *N*-monosubstituted arylcarbamates and**

-thiocarbamates. *Sv. Farm. Tidskr. 10(1): 1-12; 1973.* (24 references)

N,S-Diphenylthiocarbamate was hydrolyzed about 10^{10} times faster than *N*-methyl-*N,S*-diphenylthiocarbamate, and the hydrolysis proceeded through an isocyanate intermediate. Experiments with tris(hydroxymethyl)aminomethane were used to confirm this pathway. Comparison of rate constants obtained for these compounds with that previously reported for *N*-methyl-*N,O*,-diphenylcarbamate suggests that thiophenol is a much better leaving group than phenol in the isocyanate scheme.

73-1849. Domanski, J. J.; Sheets, T. J. (Pestic. Residue Res. Lab., N. Carolina State Univ., Raleigh, NC). **Insecticide residues on 1970 U.S. auction market tobacco.** *Tob. Sci. 17: 55-57; 1973.* (5 references)

In tests using a modified acetonitrile-water extraction procedure, tobacco samples taken from auction markets in 1970 contained smaller residues of TDE and DDT than those taken in 1968. The average value for TDE-DDT in flue-cured tobacco from all belts was 6.1 ppm in 1970 compared to a corresponding average of 53 ppm in 1968. Highest residues were found in samples from the N. Carolina-S. Carolina border and Georgia-Florida belts in both years. A number of samples still contained more than 10 ppm. Endosulfan and endrin were also found in the highest amounts in flue-cured tobacco from these belts, and toxaphene, which is not registered for use on tobacco, was found in a number of the samples at concentrations up to 8 ppm. Toxaphene was found in only four samples of burley tobacco, and levels were relatively low. Endrin residues were low in N. Carolina and Tennessee burley, but showed an increase in Kentucky burley tobacco. Large declines in TDE-DDT were noted in these samples. Significant amounts of endosulfan were found in all samples of air-cured and fire-cured tobacco, indicating that this insecticide may be replacing DDT in these areas.

See also **73-1787** **73-1797** **73-1853** **73-1941** **73-1953** **73-1970** **73-1999**
73-1792 **73-1852** **73-1854** **73-1946** **73-1956** **73-1996** **73-2000**

73-1850. Versteeg, J. P. J.; Jager, K. W. (Shell Int. Res. Maatschappij N. V., The Hague, The Netherlands). **Long-term occupational exposure to the insecticides aldrin, dieldrin, endrin, and telodrin.** *Brit. J. Ind. Med. 30(2): 201-202; 1973.* (3 references)

Workers occupationally exposed to aldrin, dieldrin, endrin, and telodrin (isobenzan) for up to 15 years through manufacturing processes were studied. No persistent adverse effects on health were observed in 52 workers who had left the company and were traced. Information was obtained on their health by a questionnaire. The average exposure in this group was 6.6 years, and an average of 7.4 years had elapsed since exposure. In the four and half years since the report was published, one man died in an accident, one suffered mild pancreatitis, and another is awaiting surgery for hyperthyroidism. The other workers experienced no illnesses other than the usual minor ones. No hepatic disease or epileptiform convulsions occurred and no new cases of malignant disease developed.

73-1851. Cattle, D. S. (Dept. Med., Harare Hosp., Ethiopia). **A case of organo-phosphorus poisoning.** *Cent. Afr. J. Med. 19(3): 52-54; 1973.* (4 references)

A 28-year-old gardener developed symptoms of acute organophosphate poisoning, presumably due to weekly exposure to an organophosphate insecticide for nine months. Excessive vomiting, abdominal pain, uncontrollable shivering, pinpoint pupils, dehydration, hypothermia, and a stuporous condition were observed when the patient was admitted; intravenous fluids were administered initially and pharyngeal suction was applied. Once a history of exposure was obtained from the employer, atropine therapy (a total of 25 mg in 40 hr) was initiated along with administration of 2-PAM. ChE activity was markedly depleted on admission and was still depleted three weeks later when the patient was discharged. Although the man had been warned that he was handling toxic substances, he did not take precautions. Protective clothing should be issued when organophosphates are used and the applicators should be instructed to wash off any insecticide that might come in contact with their bodies.

73-1852. Moulding, J. D. (Rutgers University The State University of New Jersey, New Brunswick, NJ). **The impact on forest bird and non-target arthropod populations of the use of the insecticide Sevin for gypsy moth control.** *Diss. Abstr. Int. 33(8): 3604B; 1973.*

Sevin (carbaryl) was applied aerially in June to a forest area in New Jersey at 1.1 kg a.i./hectare and treatment repeated one week later. Pre- and post-spray censuses of bird populations were conducted by the strip-transect method, and arthropods were sampled using ultraviolet light traps, sweep nets, and Berlese extraction of soil cores. The half-life of carbaryl residues collected on glass plates was 4-5 days. Less than 1% of the average initial 0.15 kg/hectare value at ground level remained after two weeks. Total numbers of birds declined beginning two weeks after spraying, attaining a 55% reduction by July. Species diversity was also reduced. Canopy-feeding birds were more greatly affected than ground-feeders. Bird populations remained at 45% of the prespray level through the following year. Bird counts in unsprayed plots did not change. Average insect biomass was not altered during the seven weeks after spraying. June beetle and fishfly populations were severely depressed. Soil collembola density in the sprayed plots was decreased three weeks after spraying. Other arthropod species were not affected. Feeding outside the sprayed area may be partially responsible for the bird population declines. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-4769.)

73-1853. Corbet, S. A.; Green, J.; Betney, E. (Westfield College (Univ. London), London, NW3, England). **A study of a small tropical lake treated with the molluscicide Frescon.** *Environ. Pollut. 4(3): 193-206; 1973.* (10 references)

The shores of a W. Cameroon lake were treated with Frescon, *N*-tritylmorpholine, as an emulsifiable concentrate in tetrachloroethylene, to control vectors of schistosomiasis, and a study was made of the long and short-term effects of treatment on aquatic life. Residues of the molluscicide and its hydrolysis product, not detectable before treatment, were 0.9 ppm to 8 ppm after a single treatment in 1972 around the shore areas, and these had substantially disappeared due to mixing within 24 hours. No obvious effects were observed on populations of fishes or invertebrates from the operation of the spray program from 1970 to 1972, probably because the animals from unsprayed areas quickly recolonize the sprayed beaches. As an immediate result of the 1972 treatment, many cichlid fishes, particularly the young that inhabited the shoreline, were killed, and several species of aquatic insects, crustaceans, and rotifers were killed or immobilized. Levels as high as 4.8 ppm did not kill ostracods and hydracarines. A granular formulation which is less toxic to fishes is now being developed.

73-1854. Anonymous. **Coming: worker re-entry regulations.** *Farm Chem. 136(2): 54,56; 1973.*

Field tests conducted by University of California researchers indicate that orchard thinning and vineyard harvest workers could go back to work much earlier than State regulations permit at no risk to health. Workers in peach and nectarine orchards treated with pesticides in amounts normally used have been able to return to work 12 days after spraying with no depression in ChE. Measurements of residues on foliage near the fruit in vineyards sprayed with ethion, guthion (azinphos-methyl), or zolone as a concentrated or dilute spray are

in progress and confirm results obtained with field workers. Decontamination by washing orchards with water or water and detergent has been studied and may also reduce re-entry times.

73-1855. Lisella, F. S. (U.S. Environ. Protection Agency, Chamblee, GA). **What roach insecticides are safe for use by allergic person?** *J. Amer. Med. Ass. 224(3): 410; 1973.* (1 reference)

Pyrethrum insecticides should not be used for roach control by persons with allergies since many allergic reactions have been attributed to these chemicals. Some of the organochlorines have been implicated in cases of chloracne, and cockroaches have developed resistance to one or more of these insecticides. Organophosphates provide excellent control, but have fairly high toxicity and have been associated with respiratory disorders in persons applying these materials. Baygon (propoxur), a carbamate insecticide, is probably the best choice for excellent control of the cockroach without unwanted reactions in the user. More detailed information on roach control with insecticides is available in a publication called *Public Health Pesticides.*

73-1856. James, W. H. (Galton Lab., University College London, London, England). **Secular changes in dizygotic twinning rates.** *J. Biosoc. Sci. 4: 427-434; 1972.* (13 references)

A study of dizygotic twinning rates in 16 countries suggests that in addition to differential contraception, environmental factors such as pesticides or growth promotants in the diet must have contributed to recent declines in DZ twinning in some of these countries. Declines have been greater in countries with fewer controls on agricultural chemical practices. Since monozygotic twinning rates have not been affected, the agent responsible for decline in DZ rates does not have an antizygotic effect, but must attack the process of double ovulation, possibly through hormonal interference.

73-1857. Nelson, W. C.; Lykins, M. H.; Mackey J.; Newill, V. A.; Finklea, J. F.; Hammer, D. I. (Div. of Health Effects Res., Nat. Environ. Res. Center, Research Triangle Park, NC 27711). **Mortality among orchard workers exposed to lead arsenate spray: a cohort study.** *J. Chronic Dis. 26(2): 105-118; 1973.* (25 references)

In a follow-up of a 1938 study on the effects of exposure to lead arsenate in an area of widespread use of the insecticide, mortality was not significantly higher in orchardists compared to consumers or infrequently exposed persons. Standard mortality ratios were 0.65 for orchardists, 0.78 for intermediates, and 0.74 for consumers, indicating that the mortality of all groups was lower than that of the Washington population in general. Inconsistent differences were observed on analysis by exposure duration or age group. Males had a higher mortality than females but lack of information on covariables, including cigarette smoking, loss of previously collected blood and urine data, and the possibility that the most susceptible subjects left orchard work before beginning of the study, make interpretation of the results difficult.

73-1858. Whelton, A.; Snyder, D. S.; Walker, W. G. (Johns Hopkins Hospital, Baltimore, MD 21205). **Acute toxic drug ingestions at the Johns Hopkins Hospital 1963 through 1970.** *Johns Hopkins Med. J. 132(3): 157-167; 1973.* (11 references)

Of the 519 acute toxic ingestion cases handled at Johns Hopkins Hospital from 1963 through 1970, 19 were pesticide ingestions. Death resulted in one of the 19 cases. A 23-yr-old girl intentionally ingested 18g of roach powder (95% sodium fluoride). Gastric lavage was performed and forced fluid diuresis was instituted. Within three hours of admission she experienced cardiopulmonary arrest secondary to ventricular fibrillation and could not be resuscitated. In the Baltimore area pesticide poisoning cases have decreased.

73-1859. Sandifer, S. H.; Keil, J. E.; Gadsden, R. H. (Sect. Preventive Med., Med. Univ. S. Carolina, Charleston, SC 29401). **The diagnosis and treatment of organophosphate insecticide poisoning.** *J. S. C. Med. Ass. 68(11): 419-421; 1972.* (3 references)

Prompt diagnosis and treatment of organophosphate poisioning are essential to prevent death. Diagnosis is based on history of exposure and symptoms of excessive stimulation of the parasympathetic nervous system, central nervous system effects, and effects on the myoneural junction, although not all of these are always observed. Red blood cell and plasma ChE determinations may be performed for confirmation. Treatment should be initiated by removing the insecticide either from the skin by washing or from the stomach by gastric lavage. Artificial ventilation should be carried out. Sufficiently large doses of atropine should be administered to maintain atropinization for at least 48 hours in severe cases. One or two doses of pralidoxime chloride are administered to reactivate ChE. Complete recovery can be anticipated if treatment is successful unless there has been damage due to hypoxia.

73-1860. Simpson, G. R.; Shandar, A. (Div. Occup. Health Pollut. Contr., Lidcombe, New South Wales 2141 Australia). **Exposure to chlorinated hydrocarbon pesticides by pest control operators.** *Med. J. Aust. 2(19): 1060-1063; 1972.*

Pest control operators performing domestic pest control work were exposed to organochlorines in amounts well in excess of the acceptable daily intake of 0.0001 mg/kg/day established for food by the WHO.

Most of the work involved treatment of buildings either before or during construction or after infestation for termites and borers. Respirators in use were in poor service condition and protective clothing was not complete and was sometimes worn over street clothes. Dermal exposure, measured by analyzing filter papers attached to various parts of the body during one-hour spray periods and expressed as the percentage estimated fatal dose per day, was minimal at 0.14% and maximal at 2.9%. Inhalation exposure, calculated as the percentage estimated fatal dose per day from the amount on the respirator pads, ranged from 0.0035% to 0.08%. It can be seen from the results that proper protective clothing is necessary during spraying and should be changed at least once a day. Respirators should be maintained in good condition.

73-1861. Nuritdinova, F. N. (Uzbek Sci. Res. Inst. Sanit., Hyg., Occup. Dis., Tashkent, USSR). **O vliyanii pestitsidov, primenyayemykh v sel'skom khozyaystve, na organ zreniya. [On the effect of agricultural pesticides on the eye.]** *Med. Zh. Uzb. 6: 66-69; 1972.* (Russian)

Results are presented of ophthalmological examinations of 683 farm workers (aged 20-50) with occupational exposure for 1-8 years, primarily to organochlorine and organophosphorus pesticides. Symptoms of chronic poisoning (sympathicotonia, asthenia, neuritis, neurocirculatory dystonia, polyneuritis, and encephalopathy) were detected in 80% of the patients with fluid imbalance. Changes in the external part of the eye in 11%, chronic allergic conjuctivitis in 33 cases, blepharitis in 6 cases, pterygium in 22 cases, atrophy of the ophthalmic nerves in 3 cases, retrobulbar neuritis in 2 cases, and angiopathy of the retina in 28 cases were diagnosed. The intraocular pressure in subjects with permanent contact with pesticides was 12.2 mm against a control value of 11.2 mm. The functional damages (reduced dark accommodation and narrowed visual field) were reversible in most cases.

73-1862. Nebut, M. (No address given). **Insecticides, herbicides et desordres respiratoires. [Insecticides, herbicides and respiratory troubles.]** *Nouv. Presse Med. 2(13): 849-851; 1973.* (15 references) (French)

Respiratory manifestations of acute poisonings with insecticides and herbicides such as paraquat and parathion are reviewed. Bronchial constriction, bronchial hypersecretion, paresis of the respiratory muscles, and depression of the respiratory centers are responsible for the serious respiratory troubles encountered in acute poisoning with parathion. The more dangerous paraquat, for which no effective antidote has yet been found, causes mostly fatal respiratory insufficiency, starting usually four days after poisoning. Lesion of the pulmonary parenchyma, diffuse alveolar secretion, edema of the alveolar walls with histiocyte infiltration, and possibly fibrillar collagen transformation due to poisoning with paraquat were observed. Chronic exposure to insecticides does not seem to be responsible for pulmonary scleroses.

73-1863. Galloway, D. S.; Petrie, J. C. (Dept. Therapeut. Clin. Pharmacol., Univ. Aberdeen, Scotland). **Recovery from severe paraquat poisoning.** *Postgrad. Med. J. 48(565): 684-686; 1972.* (8 references)

A 28-yr-old peat worker recovered from an apparently fatal dose of paraquat swallowed accidentally from a lemonade bottle. On admission 52 hours after ingestion, urinary level of paraquat was 6800μg/100 ml and pulmonary, gastrointestinal, and renal damages were typical of paraquat poisoning. Because of the delay in seeing the patient, gastric lavage and enemas and purgation were not performed, nor was bentonite administered. Forced diuresis was maintained up to day 24 and hemodialysis was carried out once for five hours, but the dialysing fluid contained no paraquat. Steroids were not administered, and although the PaO_2 fell to 66 mmHg, no oxygen was administered. The patient was discharged after 26 days and remains well three months after ingestion.

73-1864. Schreiner, G. E. (Div. Nephrol., Dept. Med., Georgetown Univ. School Med., Washington, DC). **Toxic nephropathy due to drugs, solvents and metals.** *Progr. Biochem. Pharmacol. 7: 248-284; 1972.* (81 references)

Pesticides are one of the classes of compounds considered in a review of nephrotoxins which are responsible for one-fifth of the admissions for acute renal failure at Georgetown University Hospital. Mercury produces degeneration, fragmentation, and cell necrosis in the early stages of nephropathy. In severe cases the entire nephron may be involved, and patchy tubular necrosis may occur. Gastric lavage, treatment with the chelating agent BAL, and sometimes exhange transfusions are used to counteract the effect of mercury. Arsenic has a similar action on the kidney. Peritoneal dialysis or the use of an artifical kidney are generally successful in handling acute renal failure. Diphenyl, 2,4-D, paraquat, and some organochlorines are also known to be nephropathogenic.

73-1865. Anonymous. **Common poisonings.** *Quart. Med. Rev. 22(4): 1-36; 1972.* (38 references)

In the State of Maharashtra (India) 4797 cases of alleged human poisoning were recorded in 1969 and of these 370 were attributed to organochlorines, 274 to organophosphates, and 46 to inorganic poisons like arsenic. The poisonings were usually suicidal or accidental, but occasionally homicidal, and occurred most frequently in lower socioeconomic groups. Clinical features of organophosphate poisoning are muscarinic effects, nicotinic effects, and action on the central

nervous system, and diagnosis is confirmed by determining serum ChE. Preferred therapy in the treatment of organophosphate poisoning is atropine administration. Oximes are often administered to reactivate AChE. Education of the public, particularly on the family level, to the hazards of drugs, insecticides, and other chemicals should help to reduce accidental poisonings.

73-1866. Irani, F. A.; Feil, P. A. (Deming, NM). **Parathion poisoning. A case report.** *Rocky Mt. Med. J. 69(12): 39-40; 1972.*

A farm worker who had spilled parathion on his clothing and hands one day prior to admission to the hospital was unresponsive and cyanotic on admission. Atropine was given intravenously and Ringer's lactate was begun, as well as pralidoxime therapy. Sodium bicarbonate was administered to correct acidosis and urine output was kept over 100 cc per hour to prevent precipitation of heme compounds in the kidneys. The patient regained consciousness six hours after admission. His lungs cleared and the chest x-ray was normal after five days, and he had completely recovered 16 days later.

73-1867. Watanabe, S. (Ityanagi-machi, Aomori Prefecture, Japan). **Detection of organophosphate pesticides in blood serum from the patients suspected of acute and chronic pesticides poisonings and its clinical significance.** *Tohoku J. Exp. Med. 107(3): 301-302; 1972.* (5 references)

A rapid, GC method of analysis of organophosphates in serum was developed in which samples were extracted and injected without cleanup onto a GC fitted with a phosphorus ionic detector using KBr. The column contained 2% silicone DC-QF-1 on 80-100 mesh Gaschrom Q. Of 20 cases with suspected chronic organophosphate poisoning, 14 had serum positive for organophosphate pesticides. The concentration ranges of the three insecticides observed were 0.001 to 0.980 ppm of parathion, 0.007 to 1.075 ppm of malathion, and 0.001 to 0.005 ppm of Sumithion (fenitrothion). These patients had been exposed to the pesticides for 5 to 20 years but were withdrawn from exposure six months before testing. Positive results were obtained for all 15 samples from acute cases of poisoning, and levels ranged from 0.002 to 0.667 ppm for parathion, from 0.002 to 0.570 ppm for malathion, from 0.002 to 0.667 ppm for sumithion, and from 0.001 to 0.600 ppm for salithion. High levels of insecticides corresponded with most severe symptoms of poisoning, and usually two or more organophosphates were found in one sample. No organophosphates were found in serum from 10 patients with miscellaneous diseases or from 10 controls.

73-1868. Cook, J. A.; Sturrock, R. F.; Barnish, G. (Rockefeller Foundation, New York, NY 10020). **An allergic skin reaction to a new formulation of the molluscicide clonitralide (Bayluscide).** *Trans. Roy. Soc. Trop. Med. Hyg. 66(6): 954-955; 1972.* (1 reference)

One of four spraymen engaged in application of a new emulsifiable concentrate of clonitralide developed an itching papular eruption of the fingers of both hands early in the program, and the condition was relieved with hydrocortisone cream. A year later, during a period of intense spraying, the same man developed a pruritic vesicular cutaneous eruption on an indurated erythematous base where clothing drenched with spray touched his legs. A reaction was obtained on patch testing with the emulsifiable concentrate but not with a saturated acetone extract of the active ingredient, suggesting that the sprayman was allergic to one of the other ingredients of Bayluscide e.c. rather than the clonitralide.

73-1869. Nalin, D. R. (Johns Hopkins CMRT, 550 No. Broadway, Baltimore, MD 21205). **Epidemic of suicide by malathion poisoning in Guyana.** *Trop. Geogr. Med. 25(1): 8-14; 1973.* (11 references)

Malathion poisoning has not been considered common, but in developing nations, where medical reporting is limited, malathion is used extensively and a high rate of poisoning may occur. A review of 264 cases in Guyana treated between 1962 and 1965 indicated that most of the patients drank a 57% emulsion of malathion and 20% of the patients died. Most significant signs of poisoning were clearly due to malathion itself, although other ingredients may have contributed to the unexplained deaths that occurred during convalescence. Moderately ill patients had the pungent odor of malathion, pinpoint pupils, sialorrhea with "foaming at the mouth," bronchospasm and bronchorrhea with rales or rhonchi, sweating, tearing, tachycardia, and occasionally mild stupor and biochemical abnormalities. The same signs were apparent in severely ill patients and in addition they had hypotension, coma, cyanosis, areflexia and occasionally convulsions, fasciculations, involuntary defecation, and Cheyne-Stokes respiration. Atropine therapy gave startling results, particularly in severely affected patients, and it was considered more advisable to give excess atropine than an insufficient amount. The administration of 2–PAM did not have a noticeable clinical effect. Sensational reporting by the press, availability of the pesticide, and factors relating to the Indo-Guyanese culture are believed to be the chief causes of suicide by malathion poisoning.

See also **73-1801** **73-1883** **73-1953** **73-1954** **73-1982**

73-1870. Krishnamurti, A.; Kanagasuntheram, R.; Vij, S. (Dept. Anatomy, Univ. Singapore, Faculty Med., Sepoy Lines, Singapore). **Effect of TOCP poisoning on the Pacinian corpuscles of slow loris.** *Acta Neuropathol. 22(3): 345-350; 1972.* (13 references)

Examination of digital Pacinian corpuscles taken from slow loris 45 days after poisoning with triorthocresyl phosphate (TOCP) showed extensive separation of the myelin lamellae in the proximal segment of the nerve fiber. Schwann cell cytoplasm covering the nerve fiber showed swollen mitochondria with loss of cristae. Mitochondrial changes were observed in both intermediate and terminal segments of the nerve fiber, and neurofilamentous change was noted only in the intermediate segment. Between the opposing membranes of the lamellae of the inner core and the axolemma there were some desmosome-like thickenings.

73-1871. Rasul, A. R.; Howell, J. M. (Dept. Vet. Pathol., Univ. Liverpool, P.O. Box 147, Liverpool L69 3BX, England). **A comparison of the effect of sodium diethyldithiocarbamate on the central nervous system of young and adult domestic fowl.** *Acta Neuropathol. 24(1): 68-75; 1973.* (22 references)

Oral administration six times a week of 330 mg/kg sodium diethyldithiocarbamate (DEDTC) to chicks reduced weight gain after eight weeks and produced a marked ataxia in all birds after 35 weeks. In adults given the same doses of DEDTC an immediate decrease in body weight was observed, and ataxia was first detected five weeks from the start of the experiment. One chick died in the 35 week period and three adult cockerels died in an 11-week period. Lesions in the brain and spinal cord were observed at 18 weeks in chicks and at 4 weeks in adults and were similar in nature. They consisted of degeneration of the long tracts of the spinal cord and, in birds killed at the end of the experiment, could be traced into the cerebellum. Organophosphate neurotoxicity is similar but not identical to that exhibited by DEDTC.

73-1872. Ishikawa, K.; Okuda, I.; Kuwatsuka, S. (Life Sci. Res. Inst. Kumiai Chem. Ind. Co., Ltd., Kikugawa, Shizuoka, Japan). **Metabolism of benthiocarb (4-chlorobenzyl *N,N*-diethylthiolcarbamate) in mice.** *Agr. Biol. Chem. 37(1): 165-173; 1973.* (21 references)

Benthiocarb labeled at the benzyl methylene group with carbon-14 was synthesized and its distribution, excretion, and metabolism in white mice were studied. Benthiocarb was rapidly translocated into organs after oral administration. Radioactive substances were also rapidly eliminated mainly into urine, slightly into feces, and little into expired air. Major metabolites in urine were identified as 4-chlorohippuric and 4-chlorobenzoic acids, and small amounts of glucuronides of the latter acid and 4-chlorobenzyl alcohol were detected. Benthiocarb was degraded in liver homogenates, in which the microsomal fraction showed the largest activity, and the degradation was accelerated by reduced NADP as the cofactor for the reaction. *N*-Desethylbenthiocarb, bis(4-chlorobenzyl) mono- and disulfides, and 4-chlorobenzoic acid were identified in the incubation mixture of the liver homogenates. The main metabolic pathway in mice seemed to be as follows: parent benthiocarb and/or *N*-desethylbenthiocarb were hydrolyzed, and the produced 4-chlorobenzylmercaptan was presumed to be oxidized finally to 4-chlorobenzoic acid, which then conjugated with glycine to produce 4-chlorohippuric acid. (Author abstract by permission, edited)

73-1873. Uchiyama, M.; Abe, H.; Sato, R.; Shimura, M.; Watanabe, T. (Fac. of Agr., Tokyo Univ. of Agr. and Technol., Fuchu, Japan). **Fate of 3-allyloxy-1,2-benzisothiazole 1,1-dioxide (Oryzemate) in rice plants.** *Agr. Biol. Chem. 37(4): 737-745; 1973.* (4 references)

Studies on absorption, translocation, and metabolism of 3-allyloxy-1,2-benzisothiazole 1,1-dioxide (Oryzemate), a new rice blast controlling agent, in rice plants were undertaken using the ^{35}S-labeled preparation. Oryzemate was administrated to the plants by liquid application. Uptake of labeled compound into rice plants was demonstrated by autoradiography and quantitative ^{35}S-analyses. Preferential accumulation of radioactive compounds in the leaves was observed. The metabolites in the plants were identified as allyl *o*-sulfamoylbenzoate, saccharin, and *N*-D-glucopyranosylsaccharin by cochromatography and cocrystallization with synthesized authentic compounds. Most of ^{35}S-labeled compounds accumulated in the plants were saccharin and *N*-D-glucopyranosylsaccharin. A small amount of allyl *o*-sulfamoylbenzoate was detected and Oryzemate was detectable in trace quantities at all harvest dates. (Author abstract by permission)

73-1874. Gross, W. B. (Dept. Vet. Sci., Virginia Polytech. Inst. State Univ., Blacksburg, VA 24061). **Effect of social stress on occurrence of Marek's disease in chickens.** *Amer. J. Vet. Res. 33(11): 2275-2279; 1972.* (16 references)

In chickens treated for two weeks with DDD (TDE) at 500 ppm in the feed, exposure to Marek's disease resulted in fewer tumors than in controls and the reduction persisted for five and a half weeks after treatment. A dose of 250 ppm in the feed for two weeks afforded some protection, but during the post treatment period chickens in a high stress environment had a higher incidence of tumors than those in a low stress environment. Doses greater than 500 ppm produced a higher frequency of tumors than that found in controls. Control chickens exposed to a high degree of social stress or selected for high concentration of plasma corticosterone exhibited a high incidence of Marek's disease, while those exposed to low social stress or selected for low plasma corticosterone had the disease less frequently.

73-1875. Hicks, Jr., G. F.; Corner, T. R. (Dept. of Microbiol. and Public Health, Michigan State Univ., East Lansing, MI 48823). **Location and consequences of 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl) ethane uptake by *Bacillus megaterium*.** *Appl. Microbiol. 25(3): 381-387; 1973.* (22 references)

No detrimental effects of 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane (DDT) were observed when cells of *Bacillus megaterium* were grown from small inocula in nutrient media containing up to 100 μg of DDT/ml. However, when the ratio of DDT to biomass of resting cells was held constant, levels of DDT as low as 1 μg/ml (0.5 μg/ml of cell dry weight) enhanced the rate of death in the population. The lethal action of DDT was both time- and dose-dependent so that higher doses required less time to effect the same killing than did lower doses. Intact cells bound a maximum of about 1.7 μg of DDT/mg of cell dry weight, of which about 75% was localized in the protoplast membrane. Much of the bound DDT was subsequently lost to the suspending medium and the aqueous stability of the returned DDT was enhanced, possibly by association with solubilized cell materials. A small quantity of bound DDT was converted to 1,1-dichloro-2,2-bis(*p*-chlorophenyl)ethane, which was released from cells somewhat faster than DDT. Apparently the lethal action of DDT was related to its binding in the membrane, but respiration was not inhibited. The atypical macroscopic appearance of membranes isolated from treated cells suggested that cell death may result from altered membrane chemistry. (Author abstract by permission)

73-1876. Gabliks, J.; Askari, E. M.; Yolen, N. (Dept. of Biol., Northeastern Univ., Boston, MA 02115). **DDT and immunological responses. I. Serum antibodies and anaphylactic shock in guinea pigs.** *Arch. Environ. Health 26(6): 305-308; 1973.* (19 references)

Serum antibody levels were measured in guinea pigs which had been injected with 10 to 20 mg/kg of DDT prior to and following immunization with diphtheria toxoid. Protection of animals from injected toxin, neutralization of toxin in vitro, and magnitude of γ-globulin fraction were the factors which indicated the antitoxin levels unaltered by DDT administration. The anaphylactic shock induced in the same animals by a challenge with diphtheria toxoid was markedly reduced in the DDT-treated animals. Reduced severity of the shock was also noted when DDT was injected for only three days prior to the induction of anaphylaxis: 63% of the control animals died, whereas only 22% of the DDT-treated animals died. As the antibody level was not affected, the results suggest a direct effect by DDT on the mechanism of anaphylaxis. (Author abstract by permission)

73-1877. Askari, E. M.; Gabliks, J.* (Dept. of Biol., Northeastern Univ., Boston, MA 02115). **DDT and immunological responses. II. Altered histamine levels and anaphylactic shock in guinea pigs.** *Arch. Environ. Health 26(6): 309-312; 1973.* (10 references)

Previous work demonstrated reduced severity of anaphylactic shock in DDT-treated guinea pigs. As anaphylaxis is mediated by histamine, histamine contents of tissue were examined after three doses of DDT (25 mg/kg body weight) were injected on three days prior to induction of anaphylaxis. In the DDT-treated animals histamine levels in lungs of nonimmunized and immunized animals were 62% and 71%, respectively, of the control animals, and the number of mast cells was also reduced to 36% and 67%, respectively. When guinea pig mesenteries and lungs were exposed to DDT, 10 μg/ml in vitro, the mast cell population was reduced to as low as 15% of the control values, in proportion to DDT concentration. These results indicate a release of histamine from mast cells by DDT, resulting in lower histamine content and reduced anaphylactic shock. (Author abstract by permission)

73-1878. Preston, E.; Heath, C. (Defense Res. Estab., Suffield, Alberta, Canada). **Atropine-sensitive vasodilation and hypotension in the organophosphate-poisoned rabbit.** *Arch. Int. Pharmacodyn. 200(2): 231-244; 1972.* (18 references)

The organophosphate anticholinesterases sarin, soman, or DFP rapidly induce profound hypotension in anesthetized rabbits despite artificial ventilation and atropine treatment to prevent bradycardia. Hypotension results from an atropine-insensitive vasodilation, demonstrated in the autoperfused forelimb. Soman induces depression of basal vasomotor tone; however, this is antagonized by atropine while systemic hypotension remains profound. It is suggested that hypotension stems from organophosphate effects within the neuronal vasomotor pathway. (Author abstract by permission)

73-1879. Preston, E.; Heath, C. (Dept. of Pharmacol., Univ. of Alberta, Edmonton, Alberta, Canada). **Depression of the vasomotor system in rabbits poisoned with an organophosphate anticholinesterase.** *Arch. Int. Pharmacodyn. 200(2): 245-254; 1972.* (10 references)

Anesthetized, artificially ventilated rabbits were poisoned with soman, an organophosphate anticholinesterase. Systemic hypotension occurred; vasodilatation was observed in the animal's innervated but vascularly isolated foreleg, not exposed to direct drug effects. It is concluded that soman acts within the nervous system of rabbits to depress vasomotor output by at least two effects which are either muscarinic or non-muscarinic in nature. (Author abstract by permission)

73-1880. Lipp, J. A. (Defense Res. Bd., Defense Res. Estab., Suffield, Biomed. Sect., Ralston, Alberta, Canada). **Effect of benzodiazepine derivatives on soman-**

induced seizure activity and convulsions in the monkey. *Arch. Int. Pharmacodyn. 202: 244-251; 1973.* (15 references)

The effect of clonazepam and nitrazepam upon soman-induced seizure activity and convulsions was studied in the monkey. Intravenous administration of either of these drugs, after the onset of the activity, effectively terminated the convulsions and suppressed the seizure activity. Administration of diazepam, clonazepam or nitrazepam prior to exposure of soman prevented the onset of seizure activity and convulsions with clonazepam and nitrazepam having the longest effective duration. (Author abstract by permission)

73-1881. Matthiaschk, G. (Bundesgesundheitsamt, Max von Pettenkofer-Inst., Abt. fuer Toxikol., Berlin, Germany). **Ueber den Einfluss von L-Cystein auf die Teratogenese durch Thiram (TMTD) bei NMRI-Mauesen. [On the influence of L-cysteine on thiram (TMTD)-induced teratogenesis in NMRI-mice.]** *Arch. Toxikol. 30: 251-262; 1973.* (6 references)

In female virgin mice of the NMRI strain, oral LD50 of Thiram was 2300 mg/kg (2050 mg/kg to 2500 mg/kg). Oral doses of 10, 20, and 30 mg TMTD/animal were given to female NMRI-mice from day 5 to day 15 of their pregnancy. In addition to increased resorption during the intermediate and late stages of fetogenesis, a typical syndrome of malformations with an almost linear dose-effect relationship was observed: cleft palates, micrognathy, kyphoses, wavy ribs, and distorted, wavy, and block-shaped bones of the extremities and their suspension apparatus. Simultaneous oral administration of TMTD and intraperitoneal injection of 2.5 and 5 mg, respectively, of L-cysteine per animal from day 5 to day 15 of pregnancy resulted in obvious reduction in the severity of individual malformations, while the incidence of malformations remained constant. Following administration of 30 mg TMTD/day on days 12 and 13 of pregnancy, both the overall rate of malformations and the number of individual malformations were increased as compared with the results of administration from day 6 to day 15 of pregnancy. Simultaneous administration of TMTD and intraperitoneal injection of 10 mg cysteine/animal resulted in a decreased overall rate as well as in a reduced number of individual malformations. (Author abstract by permission)

73-1882. Alsen, C.; Herrlinger, A.; Ohnesorge, F. K. (Inst. fuer Pharmakol., Abt. fuer Toxikol., Christian-Albrechts Univ., Germany). **Eigenschaften der Cholinesterasen in Geweben des Dorsches (*Gadus callarias*) und ihre Inaktivierung durch in vivo Einwirkung von Paraoxon und Tabun. [Characterization of cholinesterases of the cod (*Gadus callerias*) and their in vivo inhibition by paraoxon and tabun.]** *Arch. Toxikol. 30: 263-275; 1973.* (22 references)

The investigations presented in this paper were carried out in connection with possible contamination of the Baltic Sea by dumped tabun ammunition. By means of different substrates it was possible to demonstrate that most tissues of *Gadus callarias* (cod), (brain > myocardium ⩾ skeletal muscle ⩾ gills) contain only acetylcholinesterase (AChE, E. C.3.1.1.7.), whereas the liver also contains some butyrylcholinesterase (E.C.3.1.1.8.). Neither type of cholinesterase can be detected in erythrocytes and serum. The properties of the AChE of brain were characterized by determination of the substrate optimum ($1 \cdot 10^{-3} M$ ACh), the substrate inhibition (I_{50} at $2 \cdot 10^{-2} M$ ACh), the Michaelis constant ($Km = 1 \cdot 10^{-4} M$ ACh), and the dependence on pH and temperature (maximal activity at pH 8.5 and 37°C). The specific activity of AChE of brain or skeletal muscle is practically independent of the body weight. Exposure of living fish to concentrations of paraoxon or tabun between $1 \cdot 10^{-8} M$ and $1 \cdot 10^{-6} M$ in sea water for 0.5 to 24 hr yielded the following results: Both organophosphates were absorbed rapidly. Paraoxon inactivated the AChE of brain and of skeletal muscle with an exponential activity course at similar rates. The bimolecular rate constant (k_2) hardly differs from the one measured in vitro. The in vitro reaction of tabun was probably falsified by its hydrolysis in sea water. The AChE of muscle was inactivated to a lesser degree by tabun than was cerebral AChE. The fish died when the activity of the AChE of the brain was lowered to a 5% level by paraoxon or tabun. In spite of the extremely slow rate of reaction of cerebral AChE with either organophosphate it was possible to detect concentrations of $3 \cdot 10^{-8}$-$1 \cdot 10^{-7} M$ (0.005 to 0.015 ppm. of paraoxon and tabun) by means of the AChE inactivation after 3 to 6 hr of exposure. (Author abstract by permission)

73-1883. Dobson, K. J. (Dept. Agr., Adelaide, S. Australia). **Coumatetralyl poisoning in pigs and effectiveness of vitamin-K1.** *Aust. Vet. J. 49(2): 98-100; 1973.* (5 references)

Suspected poisoning from a warfarin-like rodenticide tracking powder (0.8% coumatetralyl) in piglets prompted an investigation of the toxicity of the compound and the usefulness of vitamin K1 therapy. Oral administration of 0.10 to 1.00 mg/kg coumatetralyl to piglets for 7 or 8 days caused lameness, external hemorrhage, weakness or paralysis and, in the case of those not treated or not treated in time, death. A single dose of vitamin K1 administered intramuscularly at 1.5 to 2.5 mg/kg was sufficient to bring about the recovery of most of the severely affected piglets, and this treatment would be economically feasible for pig producers. A synthetic analog of vitamin K administered at the same rate failed to prevent deaths in the field outbreak cited. Post-mortem findings in the five pigs that died were predominantly subcutaneous and interstitial hemorrhage with edema of the skeletal musculature.

73-1884. Snow, D. H.; Watson, A. D. J. (Dept. Vet. Pathol. Univ. Sydney, Sydney, New South Wales, 2006, Australia). **The acute toxicity of dichlorvos in the dog: 1. Clinical observations and clinical pathology.** *Aust. Vet. J. 49(3): 113-119; 1973.* (23 references)

The acute toxicity of dichlorvos in unanesthetized dogs was investigated and compared with that of parathion. The response to dichlorvos varied greatly, and there was no apparent difference in severity of clinical signs between dogs given 11 or 22 mg/kg orally or between different sexes. Intravenous administration of from 2.2 to 11 mg/kg dichlorvos gave similar responses. Apprehension and restlessness, diarrhea, ataxia, and tremors were observed in most cases. Death resulted from respiratory arrest in 3 of 12 greyhounds tested with 22 mg/kg. Signs of toxicity were similar after administration of parathion at doses from 4.4 to 44 mg/kg, but the time of onset was longer than that observed with dichlorvos. The severity of symptoms appeared to be dose related and sex-dependent. The degree of depression of RBC AChE and the increases in hematocrit observed paralleled the severity of toxic signs. In some of the dogs SGOT and SCPK were elevated, indicating possible muscle damage.

73-1885. Snow, D. H. (Dept. Vet. Pathol., Univ. Sydney, Sydney, New South Wales, 2006, Australia). **The acute toxicity of dichlorvos in the dog: 2. Pathology.** *Aust. Vet. J. 49(3): 120-125; 1973.* (14 references)

Pathological changes observed were similar after oral and intravenous administration of an acute dose of dichlorvos to dogs, and the extent of the changes was dependent on the time taken for death to occur. In dogs which died rapidly venous engorgement was the major finding, while in dogs which lived for up to two and a half hours, extensive hemorrhages in many organs as well as venous engorgement were observed. Histopathological studies revealed pulmonary changes with generalized congestion and hyperemia in rapid death cases. Longer survival resulted in more noticeable cardiovascular changes, such as extensive hemorrhages. Hyperemia and hemorrhage were not as evident after administration of parathion. In all parathion-treated dogs emphysema and atelectasis of varying degrees occurred.

73-1886. Davis, J. L.; Morris, R. O.; Tinsley, I. J. (Agr. Chem. Dept., Oregon State Univ., Corvallis, OR 97330). **Quantitative measurement of microsomal subfractions isolated from livers of rats fed with 1,1,1-trichloro-2,2-bis (*p*-chlorophenyl) ethane (DDT).** *Biochem. Pharmacol. 22(8): 869-877; 1973.* (38 references)

Fractions enriched in smooth and rough endoplasmic reticulum were prepared from rat liver microsomal membranes by centrifugation and were characterized by analysis of their protein, RNA, and phospholipid contents and by electron microscopy. Upon inclusion of 1,1,1-trichloro-2,2-bis (*p*-chlorophenyl) ethane (DDT) in the diet, the amount of liver smooth endoplasmic reticulum increased rapidly and transitorily in both weanling and adult rats to approximately twice that of control animals. The increase was more pronounced in males than in females irrespective of age, but the rate of increase (although not the maximum extent of proliferation) in male animals became significantly less as they matured. (Author abstract by permission)

73-1887. Norman, B. J.; Vaughn, W. K.; Neal, R.A. (Cent. of Environ. Toxicol., Dept. of Biochem., Vanderbilt Univ., Nashville, TN 37232). **Studies of the mechanisms of metabolism of diethyl *p*-nitrophenyl phosphorothionate (parathion) by rabbit liver microsomes.** *Biochem. Pharmacol. 22(9): 1091-1101; 1973.* (20 references)

Based on the protein content of microsomes, the administration of 3-methylcholanthrene (3-MC) and phenobarbital (PB) to adult rabbits leads to an increased rate of metabolism of parathion by rough-surfaced and whole microsomes but not by smooth-surfaced microsomes. Although prior administration of both PPB and 3-MC increased the cytochrome P-450 content of the microsomes, when the rate of metabolism of parathion was calculated on the basis of the concentration of cytochrome P-450 in these microsomes, there is no difference in the rate of metabolism of parathion by rough-surfaced and smooth-surfaced microsomes from the untreated, 3-MC-treated and PB-treated animals. However, based on the cytochrome P-450 concentration, the rate of metabolism of parathion by whole microsomes from 3-MC and PB-treated animals is less than the rate with whole microsomes from untreated animals. Further studies have shown there is no correlation between the concentration of high spin or low spin cytochrome P-450 in any of the microsomal fractions or subfractions and the rate of metabolism of parathion to paraoxon or diethyl phosphorothionate. (Author abstract by permission).

73-1888. Millard, S. A.; Hart, M. B.; Shimek, J. F. (Neurochem. Res. Lab., Dept. of Psychiatry, Univ. of Iowa Coll. of Med., Iowa City, IA 52240). **Enzymes controlling cerebral DNA synthesis: response to 2,4,5-trichlorophenoxyacetic acid and hexachlorophene.** *Biochim. Biophys. Acta 308(2): 230-233; 1973.* (17 references)

2,4,5-Trichlorophenoxyacetic acid and hexachlorophene are potent inhibitors of ribonucleotide reductase from developing brain. The inhibition was partially reversed by Fe^{2+}. Administration of 2,4,5-trichlorophenoxyacetic acid to pregnant rats resulted in inhibition of fetal cerebral ribonucleotide reductase assayed in vitro. 2,4,5-Trichlorophenoxyacetic acid did not inhibit cerebral DNA polymerase or thymidine kinase while 10^{-5}-10^{-4} *M* hexachlorophene inhibited DNA polymerase. (Author abstract by permission)

73-1889. Abramyan, E. G.; Kentikyan, M. L.; Bunatyan, L. O. (Erevan Vet. Inst., Erevan, USSR). **Aminokislotnyy sostav gidrolizatov myshechnoy tkani ovets pri eksperimental'nom otravlenii khlorofosom. [Amino acid composition of muscle tissue hydrolysates from sheep experimentally poisoned with trichlorfon.]** *Biol. Zh. Arm. 25(11): 81-84; 1972.* (2 references) (Russian)

The amino acid composition of muscle tissue hydrolysates from sheep poisoned with single 50, 100, or 300 mg/kg doses, or with daily 25 or 50 mg/kg doses of trichlorfon over 10 days was studied. Poisoning with 50 mg/kg doses decreased the lysine, glutamic acid + threonine, methionine + valine, phenylalanine, and leucine + isoleucine levels, and increased the cystine + cysteine, aspartic acid, and tyrosine levels with the total amino acid content only showing a falling tendency. Both the shifts in the amino acid fractions and the decrease in the total amino acid content of the muscle tissue hydrolysates were more pronounced in serious than in slight poisoning, indicating a correlation between the seriousness of the clinical symptoms of poisoning and the magnitude and number of doses administered.

73-1890. Hansen, D. J.; Schimmel, S. C.; Keltner, Jr., J. M. (Environ. Protect. Agency, Gulf Breeze Laboratory, Sabine Island, Gulf Breeze, FL 32561). **Avoidance of pesticides by grass shrimp (*Palaemonetes pugio*).** *Bull. Environ. Contam. Toxicol. 9(3): 129-133; 1973.* (6 references)

Experiments were conducted with grass shrimp to determine their avoidance of five insecticides and one herbicide at concentrations higher and lower than the 24 hour LC50 (determined by flowing water bioassays). Shrimp did not respond to any of the concentrations of DDT, endrin, chlorpyrifos, malathion, or carbaryl, but did avoid water containing 1.0 and 10 ppm of the butoxyethanol ester of 2,4-D. Given a choice between two concentrations of 2,4-D, the shrimp selected the lower concentration 78% of the time. The results suggest that shrimp are less able to avoid and are more sensitive to pesticides than fishes tested earlier. It is important that pesticides to be used near estuaries be tested for toxicity to shrimp and the shrimp tested for ability to avoid them.

73-1891. Gibson, J. R.; Ludke, J. L. (Dept. Zool., Mississippi State Univ., State College, MS 39762). **Effect of SKF-525A on brain acetylcholinesterase inhibition by parathion in fishes.** *Bull. Environ. Contam. Toxicol. 9(3): 140-142; 1973.* (6 references)

Inhibition of brain AChE by parathion (200 ppb) was significantly reduced in two of the three species tested when fish were pretreated for 24 hours with 1 ppm SKF-525A. Exposure of control fish to parathion for 10 hours produced 58.6, 83.7, and and 80.1% inhibition of brain AChE in shiners, green sunfish, and bluegills, respectively. Pretreated fish had reductions of 52.0, 70.2, and 82.0%, respectively, after exposure to parathion, and pretreatment alone did not affect AChE activity. SKF-525A may antagonize parathion activation in fishes as it does in terrestrial vertebrates.

73-1892. Krampl, B.; Vargova, M.; Vladar, M. (Inst. Hyg. Occup. Med., Bratislava, Czechoslovakia). **Induction of hepatic microsomal enzymes after administration of a combination of heptachlor and phenobarbital.** *Bull. Environ. Contam. Toxicol. 9(3): 156-162; 1973.* (8 references)

Additive effects were not observed in the induction of two liver microsomal enzymes, *O*-demethylase and the EPN detoxifying enzyme, when heptachlor and phenobarbital were administered to rats in ratios of 1:1, 2:1, or 1:2 based on one third LD50s of the compounds. At the 1:1 ratio, the activity of the enzymes was equivalent to that observed with heptachlor alone. A significant increase in activity was observed when the ratio was 1:2, phenobarbital:heptachlor, but the addition of the activities obtained with the compounds administered separately was greater. In a ratio of 2:1 the combination produced an activity lower than that observed with heptachlor alone. Although a single dose of one third LD50 of either compound produced a significant change in the activity of either enzyme, a double dose of either compound had practically no additional effect. The limiting factors are assumed to be the capacity of the enzymes and the doses of the drugs.

73-1893. Sinow, J.; Wei, E. (School Optometry, Univ. California, Berkeley, CA 94720). **Ocular toxicity of paraquat.** *Bull. Environ. Contam. Toxicol. 9(3): 163-168; 1973.* (11 references)

Exposure of the eye of rabbits to 0.2 ml of paraquat at concentrations ranging from 6.25% to 100% of that of the concentrate used in the field (242 mg/ml) resulted in a dose related toxicity to the eye. Maximum effect was observed nine days after administration. At the two lower concentrations severe conjunctival reactions were observed, with some instances of slight corneal damage at the 12.5% level. The iris became congested and swollen, corneal opacification increased, and a pannus reaction occurred at concentrations of 25 and 50%. An unexpected finding was the death within six days of all of the animals that had received the 100% concentration in at least one eye and the animal that had received the 50% concentration in both eyes.

73-1894. Mick, D. L.; Long, K. R.; Aldinger, S. M. (Inst. Agr. Med., College Med., Univ. Iowa, Iowa City, IA 52240). **The effects of dietary dieldrin on residues in eggs and tissues of laying hens and the effects of phenobarbital and charcoal on these residues.** *Bull. Environ. Contam. Toxicol. 9(4): 197-203; 1973.* (12 references)

Maximum dieldrin levels (> 3 ppm) in eggs from hens treated with 18 mg over an 11-day period were obtained 9 days after the last dose. Similar maxima were obtained when dieldrin-treated hens were given charcoal in the laying ration or a 100 mg phenobarbital tablet in addition to the dieldrin dose. Dieldrin residues in the livers which occurred only during dosing ranged from 0 to 228 ppb, and no residues were detected in the brain. Residues in the fat peaked at 60 ppm one day after the last dose. The only effect observed following administration of charcoal or phenobarbital was a lower level of dieldrin in livers after charcoal administration. Chicken weight and eggshell thickness were not affected by any of the treatment combinations.

73-1895. Foster, T. S. (Anim. Res. Inst., Res. Branch, Canada Agr., Ottawa, Ontario K1A OC6, Canada). **Evaluation of the possible estrogenic activity of methoxychlor in the chicken by means of feeding trials.** *Bull. Environ. Contam. Toxicol. 9(4): 234-242; 1973.* (21 references)

Feeding 1 and 10 ppm methoxychlor for periods of up to four weeks to 25-wk old pullets, 50% of which had laid their first egg, had no significant effect on weights of oviducts or their anatomical parts. Chicks of both sexes fed 1 and 10 ppm methoxychlor and 1 ppm diethylstilbestrol exhibited no significant changes in weight of testes or oviduct and ovary although a trend toward increased ovary and oviduct weights was seen with diethylstilbestrol. Should chickens be accidentally exposed to methoxychlor levels as high as 10 ppm, no significant estrogenic effects would be expected. This level produced no toxic effects over five-week feeding period.

73-1896. Kreitzer, J. F.; Spann, J. W. (U.S. Bureau Sport Fish. Wildlife, Patuxent Wildlife Res. Cent., Laurel, MD). **Tests of pesticidal synergism with young pheasants and Japanese quail.** *Bull. Environ. Contam. Toxicol. 9(4): 250-256; 1973.* (17 references)

Two of thirteen pairs of chemicals tested (malathion plus EPN and malathion plus trichlorfon) exhibited synergistic lethality to young Japanese quail and pheasants. The action of the other pairs tested in a variety of ratios (aldrin plus chlordane, Aroclor 1254 plus DDE, chlordane plus endrin, DDT plus dieldrin, malathion plus coumaphos, malathion plus parathion, phosphamidon plus fenitrothion, azinphosmethyl plus trichlorfon, Aroclor 1262 plus malathion, DDE plus Ceresan M (ethylmercury*p*-toluenesulfonamide), and dieldrin plus diazinon) appeared to be additive. The synergism observed was less pronounced than that exhibited by dogs and rats in a previous study.

73-1897. Lundberg, C.; Kihlstroem, J. E. (Inst. Zoophysiol., Box 560, S-75122 Uppsala, Sweden). **DDT and the frequency of implanted ova in the mouse.** *Bull. Environ. Contam. Toxicol. 9(5): 267-270; 1973.* (12 references)

A significant decrease in the number of implanted ova in mice was observed after administration of DDT at 50 and 100 mg/kg on day one of pregnancy or 20 mg/kg on days one and three of pregnancy. Treatment did not appear to affect the developmental stage of the fetuses. Livers of experimental animals contained DDE, *p,p'*-DDT and *p,p'*-DDD (TDE) in amounts not exceeding those found in wildlife. The effect of DDT on the frequency of implanted ova may be due to an alteration of the hormonal balance in the body.

73-1898. Hollister, T. A.; Walsh, G. E. (Environ. Protect. Agency, Gulf Breeze Environ. Res. Lab., Sabine Island, Gulf Breeze, FL 32561). **Differential responses of marine phytoplankton to herbicides: oxygen evolution.** *Bull. Environ. Contam. Toxicol. 9(5): 291-295; 1973.* (7 references)

Toxicities of urea and triazine herbicides to 18 species of marine algae were measured as inhibition of oxygen evolution from treated cultures. Atrazine was the least toxic herbicide tested; ametryne, neburon, and diuron were approximately equal in toxicity. Species of the family Bacillariophycaceae were generally least sensitive, requiring as much as 5.8 times more ametryne to reduce oxygen evolution by 50% than did Chlorophycaceae, Chrysophycaceae, and Rhodophycaceae species. The EC50 (concentration required to reduce oxygen evolution to 50% that of controls) of neburon for *Cyclotella nana* was 11 ppb, for *Nitzschia* (Indiana strain 684) it was 131 ppb. This 12-fold difference in toxicity for different species of the same family was the greatest observed in the present test. Several species from each of several families should therefore be used in studies to determine the effects of herbicides on phytoplankton.

73-1899. Carlson, G. P. (Dept. Pharmacol. Toxicol., College of Pharm., Univ. Rhode Island, Kingston, RI 02881). **Comparison of the metabolism of parathion by lobsters and rats.** *Bull. Environ. Contam. Toxicol. 9(5): 296-300; 1973.* (13 references)

An approximate 48-hr LD50 of 0.3 mg/kg was obtained when various doses of parathion were injected into the cheliped sinus of lobsters. For comparison the intraperitoneal LD50 was obtained for rats and was 7 mg/kg, the same value reported in the literature for another strain of rats. Although rats die within a few hours of administration, deaths at the lower doses in lobsters occurred between 24 and 48 hours. Conversion of parathion to paraoxon could be detected on incubation of hepatic microsomal protein from rats, but not hepatopancreatic microsomal protein from the lobster. In vitro conversion of parathion to *p*-nitrophenol by whole body homogenates was several times faster with

rats than with lobsters. The lack of correlation between toxicity data and results on in vitro metabolism may be due to the fact that another organ than the hepatopancreas is responsible for the conversion of parathion to paraoxon in the lobster.

73-1900. Peters, J. W.; Cook, R. M. (Dept. Dairy Sci., Michigan State Univ., E. Lansing, MI 48823). **Effects of atrazine on reproduction in rats.** *Bull. Environ. Contam. Toxicol. 9(5): 301-304; 1973.* (1 reference)

Atrazine fed to rats at levels from 0 to 1000 ppm in the feed from day one of pregnancy or injected at levels from 0 to 200 mg/kg s.c. did not affect the number of pups/litter or weaning weight. Injection of from 800 to 2000 mg atrazine at days 3, 6, and 9 of gestation resulted in resorption of all of the pups from five rats and a reduction of pups/litter from the other three. Day six appeared to be the critical time for effects of atrazine on reproduction. Levels which had an effect were relatively high. It was estimated that if toxicity were similar in the cow, one pound would have to be consumed for an effect to be observed on reproduction.

73-1901. Ottoboni, A.; Bissell, G. D.; Van Loon, A. J. (State of California, Dept. of Public Health, Berkeley, CA 94704). **Vitamin A content of livers and kidneys from dogs fed DDT.** *Can. J. Physiol. Pharmacol. 51: 152-156, 1973.* (11 references)

The livers and kidneys from adult beagles chronically exposed to 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane (DDT) and from their F_1 weanling progeny were analyzed for vitamin A content. The dogs, subjects of a multigeneration study of the effects of DDT on canine reproduction, were fed diets which were optimum for growth and reproduction. The DDT feeding levels were 0, 1, 5, and 10 mg technical DDT/kg body weight per day. The effect of DDT in reducing vitamin A levels in liver and kidney that has been demonstrated in other species was not manifest in adult or weanling dogs in this study. Interference by *p,p'*-DDT, *p,p'*-DDD (TDE), *p,p'*-DDE, and *p,p'*-DDMU in the analysis for vitamin A in liver and kidney tissue was investigated and found to be of no practical importance in the present study. (Author abstract by permission)

73-1902. Bunyan, P. J.; Page, J. M. J. (Pest Infest. Contr. Lab., Min. Agr., Fish. Food, Tolworth, Surbiton, Surrey, England). **Pesticide-induced changes in hepatic microsomal enzyme systems. Some effects of 1,1-di(*p*-chlorophenyl)-2,2-dichloroethylene (DDE) and 1,1-di(*p*-chlorophenyl)-2-chloroethylene (DDMU) in the rat and Japanese quail.** *Chem. Biol. Interact. 6(4): 249-257; 1973.* (27 references)

Feeding of either DDE or DDMU at 150 ppm produced a large increase in relative liver weights and microsomal protein levels in the rat, but only slight changes in microsomal protein in quail. An increase in total liver lipid was believed to have contributed to the increased relative liver weight in quail. Heart residue levels after administration of 150 ppm of the respective compounds were 86.3 ppm DDE and 12.1 ppm DDMU in quail and 2.2 ppm DDE and 0.9 ppm DDMU in the rat. This indicates that DDMU is more readily metabolized and excreted than DDE and that the rat eliminates both compounds more rapidly than quail. DDE at 150 ppm caused a small increase in cytochrome P-450 levels, no increase in *N*-demethylase levels, and a decrease in aniline hydroxylase levels in quail, while DDMU produced a 2- to 6-fold increase in enzyme levels. In the rat the increases in enzyme levels were seen after DDE administration. It is possible that in quail DDMU is metabolized via a pathway other than that of DDA to a highly active liver inducer.

73-1903. Lutz-Ostertag, Y.; David, D. (Lab. Biol. Anim., Univ. Clermont, Aubiere, France). **Action du DDT sur le tractus urogenital de l'embryon de poulet et de caille. [Effects of DDT on the urogenital tract of chicken and quail embryos.]** *C. R. Acad. Sci. Paris Ser. D 276(7): 1213-1216; 1973.* (11 references)

Effects of incubation in 0.2, 0.3, 0.5, and 1% DDT solutions were studied on the urogenital tract of male and female chicken and quail embryos. The frequency of histological and morphological changes in the gonads of male chicken and quail embryos was 90% and 100%, respectively. The chicken testicles were shrunken or hypertrophic, granulous, and contained smaller numbers of gonocytes. Male quail embryos also had smaller numbers of gonocytes, sometimes with pyknotic nuclei. The Mullerian ducts persisted in 30-47% of the male chicken embryos and in 50-80% of the male quail embryos. Both the chicken and quail embryo ovaries and right glands showed anomalies in all cases, and 0.5% and 1% DDT concentrations made the ovaries resemble testicles. The ovary and the cortex were thin and the Pfluger's cords irregular in some cases. The right glands remained thick in 60% of all cases, and the regression of the Mullerian duct was more or less inhibited, depending on the DDT concentration used. Reduced gonocyte count was also observed. The above changes, including reduced fertility and intersexuality, are not specific for DDT.

73-1904. Pfister, R. M. (Dept. Microbiol., Ohio State Univ., Columbus, OH). **Interactions of halogenated pesticides and microorganisms: a review.** *Crit. Rev. Microbiol. 2(1): 1-33; 1972.* (98 references)

Early work with organochlorines revealed few effects on soil microorganisms. Ammonification, accumulation of nitrate, and other normal soil parameters did not seem to be damaged, and the compounds themselves were remarkably stable. Some experiments indicated that microorganisms were stimulated by the

addition of lindane and BHC to the soil. Later, the conversion of DDT to TDE, a more stable compound with a broader effect, in soil was discovered. Marine organisms appear to be capable of storing DDT, endrin, and dieldrin and to be affected by their presence. Metabolism of organochlorines seems to be determined by the molecular structure and distribution of halogen atoms on the molecule. An increased oxidative state generally makes a chlorinated pesticide more susceptible to microbial attack, and cometabolism needs further study. It is now generally concluded that halogenated molecules in the environment can be broken down at least partially and in some cases to small biologically active molecules. It is apparent that microorganisms can store these compounds but the mechanism remains to be clarified. Recent work has caused concern about their effect on photosynthesis. Research techniques have evinced the changes in our environment which may result from pesticide-microorganism interaction.

73-1905. Lowndes, H. E. (Cornell Univ. Med. Coll., Ithaca, NY). **Alterations in neuromuscular function in delayed organophosphate toxicity.** *Diss. Abstr. Int. 33(6): 2730B; 1973.*

The mechanism and site of damage to nerve fibers after organophosphate poisoning were investigated, using techniques capable of disclosing subtle functional alterations. Diisopropylfluorophosphate (DFP) was administered to cats by injection into a femoral artery, and double leg soleus nerve-muscle preparations examined 7-56 days after the injection. Paresis was evident in the cats 3-4 weeks after the injections. Contractile tension and conduction velocities in the preparations were not altered at this time. The amplitude and duration of the indirectly elicited post-tetanic potentiation were depressed 2-4 weeks after treatment. The repetitive activity responsible for post-tetanic potentiation could not be detected in nerve filaments or muscles of preparations treated with DFP 21 days previously. Recovery was apparent in eight weeks. Edrophonium can initiate establishment and maintenance of generator potentials in normal preparations, but not in DFP-treated preparations. Susceptibility to transmission block by *d*-tubocurarine was increased after DFP administration. Since the functional responses tested were largely dependent on the presence of normal motor nerve terminals, the impairment of these functions suggests that DFP inflicts a lesion in the vicinity of the motor nerve terminals. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-32,961.)

73-1906. Charnetski, W. A. (Univ. of Wisconsin, Madison, WI). **Penetration and translocation of lindane into pea plants and the effects on cell structure.** *Diss. Abstr. Int. 33(7): 2944B-2945B; 1973.*

Lindane was phytotoxic to 3-day-old common garden pea seedlings at concentrations above 1 ppm when plants were grown in treated sand and at 2 ppm in nutrient solution. The epidermis was disrupted in root tips of plants grown in sand treated with lindane, apparently due to incomplete cell wall formation resulting from interference with microtubule subunit polymerization. Approximately one fourth of the radiocarbon taken up by plants grown for 30 days in sand containing 9.2 ppm of ^{14}C-lindane was located in the greens, and one third of this was in water-soluble form. Only traces of water-soluble products occurred in the roots. Only lindane and possibly γ-pentachlorocyclohexane were identified in the hexane-soluble fraction of radiolabeled material. The water-soluble products were not identified, but were very volatile. About 9% of the total radiocarbon in the plant had been converted to water-soluble form in 36 hr. The level of hexane-soluble products in the plants decreased after transfer to insecticide-free nutrient solution, and degradation of lindane to water-soluble products was accelerated. After 11 days, 94.2% of the total radiocarbon was water-soluble, compared to 54.6% after 3 days. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 72-23,727.)

73-1907. Bunch, T. D. (Utah State Univ., Logan, UT). **Effects of dieldrin on chromosomes of bone marrow and lymphocytes of the semi-domestic mallard duck.** *Diss. Abstr. Int. 33(7): 3381B; 1973.*

Juvenile mallard ducks from parents receiving long-term doses of dieldrin were maintained on similar levels of 0, 4, 10, and 30 ppm for approximately 60 days. At the end of this period, femoral bone marrow cultures were examined for chromosomal aberrations. No significant incidence of abnormalities was found within the four levels treated. Mitotic index varied little within ducks maintained on 0, 4, and 10 ppm dieldrin. However, with ducks exposed to 30 ppm dieldrin the mitotic index was reduced more than five times (significant difference $P = 0.05$). Short term in vitro lymphocytic cultures treated with 0.1, 1.0, 10.0, and 30.0 ppm dieldrin varied little from controls, whereas cultures treated with 100 ppm dieldrin had an increase in incidence of chromosome structural alterations two or more times greater ($P = 0.05$). Mitotic index was reduced in all cultures treated with dieldrin (significant difference $P = 0.05$), with the greatest decrease at 30 and 100 ppm. Comparative cytotoxic effects within lymphocytic cultures treated with 30 ppm 5-fluorouracil (mutagenic chemical) and 100 ppm dieldrin showed several similarities. The more obvious ones were: increased incidence of chromosomal gaps and breaks, reduction in mitotic index, and reduction in length and clustering of chromosomes in many cells. Mitotic activity was completely inhibited in all lymphocyte cultures treated with 100 ppm 5-fluorouracil. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 73-875.)

73-1908. Bell, A. R. (North Dakota State Univ., Fargo, ND). **Uptake, translocation, and metabolism of dicamba, 2,4-D, and picloram in kochia.** *Diss. Abstr. Int. 33(8): 3425B; 1973.*

Foliar absorption of dicamba, 2,4-D, and picloram by excised kochia leaves did not differ sufficiently to explain the differences in toxicity of herbicides to these plants. Translocation of dicamba and 2,4-D to leaves and stems was appreciable, whereas picloram translocation was not significant. Wild buckwheat did not metabolize root or foliarly applied picloram within seven days after treatment, as determined by thin-layer chromatography. Foliarly applied dicamba, 2,4-D, and picloram were not metabolized by kochia within seven days after treatment. Root applied dicamba or 2,4-D was not metabolized by kochia. However, root treated kochia formed a conjugate of picloram which was translocated from the roots to the shoots. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-1911.)

73-1909. Hyde, K. M. (Louisiana State Univ. and Agr. and Mech. College, Baton Rouge, LA). **Studies of the responses of selected wildlife species to mirex bait exposure.** *Diss. Abstr. Int. 33(8): 3693B-3694B; 1973.*

Effects of mirex on wildlife species of economic and/or recreational value were studied in Louisiana. Production of red crawfish in experimental ricefield plots was reduced by treatment with three applications of mirex bait at 1.25 lb per acre whereas number of crawfish harvested was not reduced in plots treated with a combination of mirex, malathion, and carbofuran. Mirex residues from treated plots averaged 0.284 ppm. Survival of channel catfish was reduced by approximately 33% in test ponds treated at 1.25 lb per acre. Mirex residues in edible parts of treated catfish averaged 0.018 ppm. Mirex incorporated into the diets of mallards at 100 ppm reduced two-week duckling survival from 96% to 73%. Eggshells from mallards fed 1 ppm mirex were slightly thicker and heavier than those of controls, whereas shells from those receiving 100 ppm were thinner and lighter than those of controls. After 18 weeks of feeding, mirex accumulated in eggs at 2.4-2.8 times the dietary level. The concentration factor of mirex in liver, wings, and fat ranged from 1.5 to 30 times the dietary level. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-2962.)

73-1910. Hall, S. M. (Univ. of California, Los Angeles, CA). **Effects on pregnant rats and their progeny of adequate or low protein diets containing 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) or *p,p'*-DDT.** *Diss. Abstr. Int. 33(8): 3744B; 1973.*

When pregnant rats were fed six percent casein diets containing either 2,4,5-T or DDT, there was a reduction in food intake and weight gain as well as in food and protein efficiency ratios. Adequate levels of dietary protein protected these dams against the toxic effects of DDT, but not 2,4,5-T. There was, however, no protection given to their progeny, as in these animals there were reductions in body and tissue weights in addition to alterations in tissue DNA and protein content. Neither DDT nor 2,4,5-T affected the placenta when the mothers received adequate protein diets, but the toxicity of these compounds was potentiated by low protein diets. In progeny from dams fed either additive, brain weight reductions could have been caused by a reduction in constituents other than DNA and protein, whereas progeny from dams fed 2,4,5-T and low protein diets had a decrease in brain weight due to a decrease in cell number. Progeny from dams fed low protein plus either additive, or adequate protein plus 2,4,5-T had a decrease in liver weight due to a reduction in liver protein content, whereas progeny from dams consuming low protein diets containing 2,4,5-T had reductions in liver weight caused by cell number as well. Thus, 2,4,5-T and DDT had toxic effects on the mothers and their progeny, which were accentuated when these substances were incorporated into low protein diets. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-1700.)

73-1911. Schnorr, J. K. (Iowa State Univ., Ames, IA). **Effects of dieldrin on learning and retention of a visual discrimination task in sheep.** *Diss. Abstr. Int. 33(8): 3995B; 1973.*

Twenty-four sheep were trained on an operant visual discrimination task. Three groups of six animals were exposed to 5.0 mg dieldrin/kg, 2.5 mg dieldrin/kg, or 0.5 mg dieldrin/kg while the remaining six animals served as controls. The animals learned four problems: two problems before exposure and two additional problems during exposure. Exposure was continued while the animals relearned problem two. Dieldrin significantly increased the number of days required for learning new visual problems. All animals in the 5.0 mg/kg and 2.5 mg/kg groups showed some form of toxicosis while none of the animals in the 0.5 mg/kg groups showed any signs of toxicosis or behavioral decrements. The sensitivity of the visual task for lower dosages appeared to be limited by the number of days of exposure. Behavioral decrements for the highest dosage group (5.0 mg/kg) appeared within 37 days of exposure. Blood dieldrin levels were negatively correlated with body weight and positively correlated with behavioral decrements. Contrary to previous reports of the learning ability of sheep, the animals demonstrated a visual ability comparable to other higher mammals. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 73-3927.)

73-1912. Smith, R. M. (Iowa State Univ., Ames, IA). **Successive discrimination reversal and dieldrin toxicity**

in the squirrel monkey (*Saimiri sciureus*). *Diss. Abstr. Int. 33(8): 3997B; 1973.*

Laboratory-acclimated squirrel monkeys were trained to perform a non-spatial successive discrimination reversal task. One group of monkeys was given 0.01 mg/kg dieldrin for 55 days, then 0.10 mg/kg for 54 days; another group received 0.10 mg/kg dieldrin for 55 days and placebo for 54 days. Statistical analyses of performance on the test revealed a significant difference between high and low dosage groups, but no significant difference between low and nil dosage groups of monkeys. The hypothesis that daily oral exposure to dieldrin at 0.10 mg severely suppressed learning acquisition was statistically confirmed. Neither the high nor the low dose rate affected maintenance of the learned task. The high dose rate used in this study is about 16% of the estimated exposure rate in some occupational groups. Circumstantial evidence implicated the hippocampus as the site most susceptible to dieldrin toxicity. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-3931.)

73-1913. Elsberry, D. D. (Iowa State Univ., Ames, IA). **Effect of dieldrin on auditory detection behavior and central auditory mechanisms in sheep.** *Diss. Abstr. Int. 33(8): 4028B-4029B; 1973.*

The electrophysiologic activity of the dorsal cochlear nucleus, ventral cochlear nucleus, trapezoid body, inferior colliculus, medial geniculate body, hippocampus, and temporal cortex was monitored with radiotelemetry from five sheep which were surgically prepared with depth recording electrodes. A digital computer analyzed the electrophysiologic data from these structures during the animal's performance in an auditory detection task for three five-day periods prior to, during, and following dieldrin exposure. Technical dieldrin was orally administered at 15 mg/kg body weight for five consecutive days. All animals had a significant decrement in the percentage of correct responses during auditory detection testing following dieldrin exposure. The mean total energy of power spectra was found to be a sensitive correlate for the prediction of the animal's behavioral response to the auditory detection task prior to dieldrin exposure. Following dieldrin exposure, this parameter became altered to the extent that an opposite energy trend relative to behavioral response was noted. The hippocampal mean total energy was significantly increased during incorrect behavioral responses prior to dieldrin exposure; however, following dieldrin exposure, the mean total energy of power spectra of the ventral cochlear nucleus and trapezoid body had similar alterations. The most significant effect upon mean total energy was observed from the trapezoid body during dieldrin toxicosis. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-3879.)

73-1914. Hair, E. M. (Ohio State Univ., Columbus, OH). **Effects of dieldrin on walleye egg development, hatching and fry survival.** *Diss. Abstr. Int. 33(8): 4038B; 1973.*

Walleye eggs reared in a miniature jar hatchery were continuously exposed to 0, 1, 10, or 100 ppb dieldrin from spawning until hatching. After hatching fry were held in 4-l. glass battery jars until yolk sac absorption was complete. Eggs absorbed dieldrin from the water at all levels of exposure. The amount absorbed depended on the concentration in water and varied with the duration of exposure. Corresponding with the appearance of eyes in the embryos, there was a sharp increase in dieldrin uptake. After five days of exposure eggs had concentrated levels in the water by factors of 800-1200. Dieldrin absorbed by developing walleye eggs did not affect embryo development, rate of development, or hatchability. At 10 and 100 ppb fry survival was affected. After exposure to 10 or 100 ppb, fry became pigmented sooner and were more active than the controls. An apparent increase in the growth of fry from eggs exposed to 100 ppb dieldrin occurred between two and three days after hatching but may have been the result of death of smaller, weaker individuals rather than an actual change in growth rate. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, Order No. 73-2012.)

73-1915. Kang, Y. H. (Brigham Young Univ., Salt Lake City, UT). **Reproduction and development of *Ferrissia rivularis* (Say) (Basommatophora: Ancylidae) and the effects of maleic hydrazide on its development and fecundity.** *Diss. Abstr. Int. 33(8):4040B-4041B; 1973.*

This research deals with the normal reproduction and development of *Ferrissia rivularis* (Say) and also the morphogenic effects of the herbicide maleic hydrazide (MH) on its development and fecundity. Electron microscope observations indicate that spermatid tails are distinctly different in structural detail from mature sperm tails. Also, young oocytes have three or four follicle cells connected through intervening periocytic spaces by electric couplings which disappear during vitellogenesis when the microvilli and vitelline membrane appear. Oogenic and spermatogenic zones, well defined in the mature ovotestis, are not seen in the young ovotestis. Self-fertilization occurs in this species. Seven stages of the limpet's fourteen day developmental period are designated for observational purposes. Maleic hydrazide reduces egg production and causes the following malformations of embryos and larvae: blastomere separation, arrested blastulae, vesicular and dumbbell-shaped hydropic exogastrulae, hydropic trochophores, hydropic veligers, and head and shell deformities. (Author abstract by permission. Copies of the thesis are available from University Microfilms, Order No. 73-2868.)

73-1916. Emanuel', N. M.; Shulyakovskaya, T. S.; Kondrat'yeva, V. A. (Inst. Chem. Phys., Acad. Sci.

USSR, Moscow, USSR). **Izmeneniye soderzhaniya svobodnykh radikalov v tkanyakh organizma pri toksicheskom deystvii khimicheskikh soyedineniy. [Changes in the free radical content of animal tissues as an index of the toxic effects of chemicals.]** *Dokl. Akad. Nauk. SSR 209(5): 1213-1214; 1973.* (9 references) (Russian)

Changes in the free radical content in liver and brain tissues were studied in male Wistar rats fed 50 mg of DDT and 0.1-0.2 ml of benzene per kg of body weight in a 55-day-experiment. Electron spin resonance spectroscopy determined a decrease on the first and a sharp increase on the second day in the free radical content of the liver tissues of DDT-fed animals. The free radical content started to decrease and reached normal levels on the sixth day of poisoning, after which it stabilized at a below-normal level for the rest of the experiment. The free radical content of brain tissues decreased considerably to stabilize finally at a value corresponding to about one third the normal level by the 20th day of the experiment. Benzene had similar effects on the hepatic and cerebral free radical contents. With consequences yet unknown, any departure from the normal free radical levels, up or down, should be regarded as harmful for the organism.

73-1917. Madill, H. D.; Parker, J. M. (Defense Res. Establish. Suffield, Ralston, Alberta, Canada). **The potentiating effect of DFP upon the central tremorgenic potency of nicotine-*N*-oxide in mice.** *Drugs Cholinergic Mech. CNS Proc. Conf., Foersvarets Forskningsanstalt, Stockholm, Sweden, 1970, pp. 529-541.* (19 references)

DFP pretreatment in mice at one-half the intravenous LD50 potentiated the tremorgenic effects of nicotine-*N*-oxide by a factor of 48, but had no effect on the tremor produced by nicotine, probably because nicotine was more potent than the oxide as a direct-acting nicotinic agonist. Atropine administration partially reduced the DFP potentiation when the dose was 3 mg/kg and completely eliminated it when the dose was 15 mg/kg. Significant increases were observed in "free" and "bound" ACh in the brain after administration of DFP and in "free" ACh after DFP and nicotine-*N*-oxide. A similar pattern of mobilization of ACh under conditions of depressed brain cholinesterase was observed with nicotine.

73-1918. Fukuto, T. R. (Dept. Entomol., Univ. California, Riverside, CA 92502). **Metabolism of carbamate insecticides.** *Drug Metab. Rev. 1(1): 117-151; 1972.* (62 references)

A review of recent literature on metabolism of carbamates indicates that these insecticides are degraded by at least two different processes. The principal route, and generally the first step, is oxidative in nature and probably involves mixed-function oxidases in animals and similar enzymes in plants. Groups most susceptible to oxidation, such as the thioethers, are the first to be attacked. A hydroxyl moiety is usually introduced by the oxidative reaction and conjugation generally follows. Hydrolysis of the carbamate linkage is another important pathway with the liberation of the phenolic or equivalent moiety which can also be conjugated. Specific agents reviewed include: carbaryl, Zectran, aminocarb, formetanate, aldicarb, Mobam, methiocarb, carbofuran, meobal, Landrin, carbanolate, and propoxur. Most frequently non-toxic metabolites are formed, but some toxic metabolites such as aldicarb sulfoxide, *N*-demethyl dimetilan, and *N*-demethyl and *N*-formyl Zectran are produced.

73-1919. Wilkinson, C. F.; Brattsten, L. B. (Dept. Entomol., Cornell Univ., Ithaca, N.Y. 14850). **Microsomal drug metabolizing enzymes in insects.** *Drug. Metab. Rev. 1(2): 153-228; 1972.* (300 references)

Microsomal drug metabolizing enzymes in insects can be influenced by physiological and environmental factors which may impart susceptibility or resistance to the insects. Inhibition of insect mixed function oxidases has been studied extensively in a search for pesticide synergists. Resistance in insects is often related to an inherited increased ability to metabolize insecticides. These factors are discussed in a review of the preparation, properties, and interactions of microsomal activity in insects.

73-1920. Stitzel, R. E.; Stevens, J. T.; McPhillips, J. J. (Dept. Pharmacol., W. Virginia Univ. Med. Cent., Morgantown, WV 26506). **Effects of environmental organophosphorus insecticides on drug metabolism.** *Drug Metab. Rev. 1(2): 229-248; 1972.* (69 references)

A review of the effects of organophosphates on enzymes other than ChE indicated that many of these insecticides can alter both the in vitro and in vivo rates of drug metabolism. Studies with malathion and parathion have shown that induction of microsomal enzymes by these compounds is independent of their conversion to oxygenated metabolites which are the active ChE inhibitors. Potentiation of organophosphate toxicity by other organophosphates appears to be related to inhibition of aliesterases which generally inactivate these ChE inhibitors. Changes elicited in the intensity or duration of activity of useful drugs have been illustrated by the prolongation of hexobarbital sleeping time in mice treated with organophosphates and the increased toxicity observed with tolbutamide or bishydroxycoumarin. Paraoxon consistently enhanced aniline hydroxylase activity in microsomal preparations from rats, mice, rabbits, dogs, and humans.

73-1921. Queinnec, G. (Ecole Nat. Vet., Toulouse, France). **Pollution et derive genetique. [Pollution and genetic derivation.]** *Econ. Med. Anim. 13(6): 361-373; 1972.* (French)

Studies on the relationship between environmental factors and genetic derivation in humans and animals are reviewed. Low pollution levels almost always evoke a genetic response, and the major function of biparental reproduction lies in the prevention of genetic blockade, which permits adaptation. Intense pollution, however, suppresses all reproductive capacities before resistance can develop. The evolution of the LD50 values of insecticides in successions of arthropod generations can be described by a sigmoid curve rising steeply in the 10th generation and reaching its maximum in the 30th generation. The dehydrochlorination factor, controlling the resistance to DDT in fly, was localized in autosome II. Loci of alleles responsible for the resistance to lindane, cyclodienes, naphthalene, organophosphorus compounds, carbamates, and tributyline chloride have been determined.

73-1922. Sanders, H. O.; Mayer, Jr., F. L.; Walsh, D. F. (Fish-Pesticide Res. Lab., Bureau of Sport Fish. and Wildl., U.S. Dept. of Interior, Columbia, MO 65201). **Toxicity, residue dynamics, and reproductive effects of phthalate esters in aquatic invertebrates.** *Environ. Res. 6(1): 84-90; 1973.* (22 references)

Aquatic invertebrates were exposed to di-*n*-butyl and di-2-ethylhexyl phthalate esters in water to determine toxicity, accumulation, and reproductive effect of these compounds. The acute toxicities were low and ranged from 2.1 mg/liter to greater than 32 mg/liter. Residue accumulation was rapid resulting in body residues 70-13,600 times that of the water concentration. Phthalate residues were essentially gone after 10 days in fresh water. A reproductive impairment of 60% occurred in *Daphnia magna* exposed continuously to 3 μg/liter of di-2-ethylhexyl phthalate. (Author abstract reprinted by permission of Academic Press)

73-1923. Murray, R. E.; Gibson, J. E. (Michigan State Univ. Cent. Lab. Anim. Resources, East Lansing, MI 48823). **A comparative study of paraquat intoxication in rats, guinea pigs, and monkeys.** *Exp. Mol. Pathol. 17(3): 317-325; 1972.* (17 references)

The acute toxicity, clinical syndrome, and pathology of paraquat was characterized in rats, guinea pigs, and monkeys. The 7-day LD50 values in mg/kg for orally administered paraquat were 126 for rats, 22 for guinea pigs, and 50 for monkeys. Signs of intoxication included anorexia, adipsia, diarrhea, hyperpnea, dyspnea, and tachycardia. The time between paraquat exposure and sacrifice or death influenced the extent and character of the lesions produced. Lungs exhibited the most prominent lesions. Focal necrosis was also observed in the liver, kidney, and gastrointestinal tract. Monkeys developed progressive interstitial fibrosis in the lung, but guinea pigs did not.

73-1924. Petrova-Vergieva, T.; Ivanova-Tchemishanska, L. (Inst. of Hyg. and Occup. Health, Sofia, Bulgaria). **Assessment of the teratogenic activity of dithiocarbamate fungicides.** *Food Cosmet. Toxicol. 11: 239-244; 1973.* (10 references)

The dithiocarbamate fungicides, maneb and zineb, were given in a single oral dose to groups of pregnant rats on day 11 or 13 of organogenesis. Single doses of 1-4 g maneb/kg and 2-8 g zineb/kg induced congenital anomalies in 12-100% of the fetuses. The maximum dose rate at which no teratogenic effect was observed was 0.5 g/kg for maneb and 1 g/kg for zineb. No adverse effect on the intrauterine development of the progeny was observed when the latter dose levels were given daily to groups of rats from day 2 to day 21 of pregnancy or when the rats were exposed in a dynamic inhalation chamber to a concentration of 100 mg zineb/m^3 for 4 hr/day from day 4 of pregnancy. The authors conclude that the present exposure to dithiocarbamate fungicides in agriculture is unlikely to present a hazard to the normal development of the human embryo. (Author abstract by permission)

73-1925. Abramova, Zh. I.; Chernyy, Z. Kh.; Boltushkina, L. A. (Inst. Occup. Health Occup. Dis., Leningrad, USSR). **K patogenezu intoksikatsi granozanom. [Pathogenesis of granosan (ceresan) poisoning.]** *Gig. Tr. Prof. Zabol. 16(11): 21-24; 1972.* (5 references) (Russian)

Pathogenesis of granosan poisoning was studied in albino rats and mice. Rats were given s.c. doses of 5 mg/kg twice a week for 45 days and mice were given 5 mg/kg body weight daily for 20 days through a stomach tube. The metabolism of monoamine and acetylcholine mediators was studied by pharmacological and biochemical methods. Weakened pharmacological effects of phenamine, apomorphine, and reserpine, changes in the serotonin and catecholamine levels in the subcortical brain formation and in the gastric wall, and increased output of 5-hydroxyindoleacetic acid and epinephrine in the urine were determined. Both the disturbed enzyme systems commanding the biosynthesis of biogenic amines and the metabolism of the latter should be considered as important factors in the pathogenesis of the granosan neurointoxication and also in the ulcerogenic action of granosan.

73-1926. Shiplov, J.; Graber, C. D.; Keil, J. E.; Sandifer, S. H. (Dept. Microbiol., Med. Univ. S. Carolina, Charleston, SC). **Effect of DDT on antibody response to typhoid vaccine in rabbits and man.** *Immunol. Commun. 1(4): 385-394; 1972.* (10 references)

The effect of DDT on the immune response of man and rabbits was investigated. A 13-fold rise in Geometric Mean Titre (GMT) of O antibody over baseline levels and an 8-fold rise over control levels was observed in DDT-dosed humans. A 3-fold increase in H

antibody levels and generally higher Vi hemagglutins were also observed in treated subjects. In both test and control groups, immunoglobins were essentially normal throughout the experiment. No discernible effects from DDT ingestion were observed. DDT serum levels rose from 10.1 to 22.1 ppb in treated subjects. The GMT for H antibody was 1.3 times that of controls in DDT-treated rabbits 10 days following *S. typhi* administration. Measurement of O agglutination indicated that the anamnestic response to the vaccine was higher in DDT-dosed animals than in controls. Anamnestic agglutinins to H antigen but not Vi were also higher in treated animals. DDT serum levels rose in rabbits from 0 prior to treatment with 10 mg/kg to 54 ppb in rabbits given *S. typhi* vaccine and 73 ppb in rabbits given no vaccine. One rabbit died immediately after its last scheduled dose of DDT. The results of this study do not agree with those of a previous report in which DDT-fed animals injected with *S. typhi* experienced a 30% decrease in antibody titre to whole organisms.

73-1927. Graham, S. L.; Hansen, W. H.; Davis, K. J.; Perry, C. H. (Bur. of Foods, Food and Drug Admin., Dept. of Health, Educ., and Welfare, Washington, DC 20460). **Effects of one-year administration of ethylenethiourea upon the thyroid of rat.** *J. Agr. Food Chem. 21(3): 324-329; 1973.* (6 references)

Male and female Charles River rats, approximately 5-weeks-old, were fed ethylenethiourea (ETU) for 2, 6, or 12 months at levels of 0, 5, 25, 125, 250, or 500 ppm in the diet. Body weight, thyroid and other organ weights, thyroidal ^{131}I uptake, hematology, and histology were the criteria studied. Significant decreases in body weight and increases in thyroid weight were seen at the 125-, 250-, and 500-ppm levels. Uptake of ^{131}I was significantly decreased in male rats after 12 months at 500 ppm but was increased in females. After 12 months, microscopic examination of the thyroids revealed the development of nodular hyperplasia at dose levels of 125 ppm and higher; carcinomas were found at dose levels of 250 and 500 ppm. The development of thyroid carcinomas indicates that under the conditions of this study ETU is a carcinogen. (Author abstract reprinted by permission of the American Chemical Society)

73-1928. Mayer, R. T.; Wade, A. E.; Soliman, M. R. I. (Vet. Toxicol. and Entomol. Res. Lab., Agr. Res. Serv., U.S. Dept. of Agr., College Station, TX). **Juvenile hormone analogs as in vitro inhibitors of rat liver microsomal oxidases.** *J. Agr. Food Chem. 21(3): 360-362; 1973.* (28 references)

Three juvenile hormone analogs were found to be in vitro inhibitors of rat liver microsomal oxidases. Aniline hydroxylase reactions gave apparent inhibition constants of 8×10^{-5} *M* and 1.4×10^{-4} *M* for (E)-4-[(6,7-epoxy-3,7-dimethyl-2-nonenyl)oxy]-1,2-(methylenedioxy)benzene and (E)-4-[(6,7-epoxy-3-ethyl-7-methyl-2-nonenyl)oxy]-1,2-(methylenedioxy)benzene, respectively. (E)-6,7-Epoxy-1-(*p*-ethylphenoxy)-3,7-dimethyl-2-octene, the least active, had an apparent inhibition constant of 2.5×10^{-4} *M*. Cytochrome P-450 binding for all three compounds was observed to be of the type I category. The results provide evidence that JH analogs react with mammalian tissues and are thus not completely insect specific. (Author abstract reprinted by permission of the American Chemical Society)

73-1929. Myhr, B. C. (Battelle, Columbus Lab., Columbus, Ohio 43201). **A screen for pesticide toxicity to protein and RNA synthesis in HeLa cells.** *J. Agr. Food Chem. 21(3): 362-367; 1973.* (28 references)

Suspension cultures of HeLa cells were used in a screen for toxicity based upon an initial biochemical response rather than the usual measurements of growth inhibition. Cells were exposed for 30 min to 350 μg/ml dosages of 30 different pesticides, and the effects on [^{3}H]uridine and ^{14}C-labeled amino acids incorporation into RNA and protein were determined. Dose-response curves for DDT, aldrin, carbaryl, and parathion yielded LD50 values that showed this method was as sensitive as 48-hr growth measurements. One-half of the compounds studied had no effect on one or both incorporation activities. Eight pesticides selectively inhibited amino acid incorporation, while only one, chlorpropham, was a selective inhibitor of uridine incorporation. Propham, however, inhibited both processes. The actions of the organophosphorus compounds were as varied as the side chains, but all of the chlorinated hydrocarbons except dieldrin strongly inhibited amino acid incorporation. Uncouplers of oxidative phosphorylation were highly inhibitory. (Author abstract reprinted by permission of the American Chemical Society)

73-1930. Andrawes, N. R.; Romine, R. R.; Bagley, W. P. (Union Carbide Corp., Res. and Develop. Dept., South Charleston, WV). **Metabolism and residues of Temik aldicarb pesticide in cotton foliage and seed under field conditions.** *J. Agr. Food Chem. 21(3): 379-386; 1973.* (12 references)

The fate of *S*-methyl-^{14}C-aldicarb pesticide was studied in field-grown cotton. Aldicarb sulfoxide, aldicarb sulfone, and water-soluble noncarbamate metabolites constituted the major portion of the residual ^{14}C materials in the foliage and seed. Pesticide residue analysis of samples from commercially treated fields qualitatively agreed with the carbamate residues found in the metabolism studies with [^{14}C]aldicarb. Residue methods are described for characterizing the aldicarb carbamate residues in cotton foliage and for determining the total toxic residue in cottonseed. (Author abstract reprinted by permission of the American Chemical Society)

73-1931. Pfaender, F. K.; Alexander, M.* (Grad. Field of Microbiol. and Lab. of Soil Microbiol., Cornell Univ., Ithaca, NY 14850). **Effect of nutrient additions on the apparent cometabolism of DDT.** *J. Agr. Food Chem. 21 (3): 397-399; 1973.* (10 references)

DDD, DDE, and 4,4′-dichlorobenzophenone (DBP), were produced in sewage treated with DDT. The addition of glucose enhanced the rate of DDD formation but slowed DBP biosynthesis, and additions of diphenylmethane reduced the rate of formation of both DDD and DBP. The numbers of microorganisms potentially able to cometabolize DDT were high in raw sewage, but their abundance rose markedly as a result of the addition of glucose and diphenylmethane. Many of these microorganisms produced DDD, DDE, and DBP.

73-1932. Sikka, H. C.; Saxena, J. (Life Sci. Div., Syracuse Univ. Res. Corp., Syracuse, NY 13210). **Metabolism of endothall by aquatic microorganisms.** *J. Agr. Food Chem. 21(3): 402-406; 1973.* (16 references)

[^{14}C]Endothall [7-oxabicyclo(2.2.1)heptane-2,3-dicarboxylic acid] labeled in the oxabicyclo ring was readily degraded by microoganisms in lake water and hydrosoil through a pathway involving splitting of the ring. An *Arthrobacter* species isolated from hydrosoil by the enrichment method was able to utilize endothall as the sole source of carbon and energy for its growth. The ^{14}C from endothall was incorporated into cellular amino acids, proteins, nucleic acids, and lipids and was also released as $^{14}CO_2$. After short-term incubation of the *Arthrobacter* with [^{14}C]endothall, ^{14}C was incorporated into citric, aspartic, and glutamic acids and some unidentified compounds. [^{14}C]Glutamic acid accounted for a large proportion of the total ^{14}C incorporated into the alcohol-soluble cell fraction. Treatment with 2×10^{-2} *M* monofluoracetate caused a severalfold accumulation of [^{14}C]citric acid, but only partially inhibited the incorporation of ^{14}C into glutamic acid. It appears, therefore, that the ^{14}C from ^{14}C-ring-labeled endothall is incorporated into glutamic acid via the tricarboxylic acid cycle and an alternate, unknown pathway. (Author abstract reprinted by permission of the American Chemical Society)

73-1933. Varela-Aivarez, H.; Sink, J. D.*; Wilson, L. L. (Dept. of Anim. Sci., Pennsylvania State Univ., University Park, PA 16802). **Certain physiological factors affecting organochlorine pesticide metabolism in ovine females.** *J. Agr. Food Chem. 21(3): 407-409; 1973.* (12 references)

Twenty-eight crossbred 2-year-old ewes were used to determine the effects of pregnancy and lactation on the body storage of DDT and dieldrin and on their elimination in milk. Pregnancy did not significantly affect total DDT degradation in ewes, but significantly affected dieldrin metabolism. Body fat from pregnant animals averaged higher in dieldrin concentration at parturition than did that of nonpregnant animals at a comparable sampling time. After parturition DDT, DDT metabolites, and dieldrin decreased steadily with time. Lactation status significantly affected DDD concentrations and the total DDT:dieldrin ratio. Residues in body fat of lactating animals decreased faster than those of nonlactating animals. However, the rate of pesticide decrease was similar in nonlactating and nonpregnant animals. The concentration of DDT metabolites in milk fat was proportional to the total DDT concentration in body fat. However, dieldrin in milk fat was not correlated with dieldrin concentration in body fat.

73-1934. Varela-Alvarez, H.; Sink, J. D.*; Wilson, L. L. (Dept. of Anim. Sci., Pennsylvania State Univ., University Park, PA 16802). **Certain physiological factors affecting organochlorine pesticide metabolism in young ovines contaminated in utero.** *J. Agr. Food Chem. 21(3): 409-411; 1973.* (15 references)

Thirty crossbred lambs (15 males and 15 females), the progeny of ewes contaminated with DDT and dieldrin, were used to determine the effects of placental transfer, length of contamination, sex, and age on the body storage and elimination of these pesticides. Three lambs of each sex were sacrificed at birth. Similar numbers of both a suckling and an artificially raised group were sacrificed at 5 and 10 weeks of age. Placental transfer of the pesticides occurred, resulting in contamination of all newborn lambs. Suckling lambs accumulated significantly more DDT, DDT metabolites, and dieldrin because of constant exposure to pesticide through their mother's milk. Of the suckling lambs, females stored significantly more DDT and DDT metabolites than did males, but dieldrin storage was the reverse. (Author abstract reprinted by permission of the American Chemical Society)

73-1935. Wright, F. C.; Palmer, J. S.; Riner, J. C. (U.S. Livestock Insects Lab., Agr. Res. Serv., U. S. Dept. of Agr., Kerrville, TX 78028). **Accumulation of mercury in tissues of cattle, sheep, and chickens given the mercurial fungicide, Panogen 15, orally.** *J. Agr. Food Chem. 21(3): 414-416; 1973.* (8 references)

Yearling cattle and sheep and 6-week-old chickens were given daily oral doses of the mercurial fungicide Panogen 15 (methylmercury dicyandiamide). Cattle and sheep were given 15 mg of the total formulation per kg of body weight daily to 70 days, and chickens were dosed at both 5 and 10 mg/kg daily to 84 days. Two yearling cattle and three yearling sheep were mildly poisoned in the latter stages of the study. Residues of mercury, determined by atomic absorption spectrophotometry, were generally higher in cattle than in sheep except in the liver. The order of increasing residues in both cattle and sheep was brain, muscle, liver, and kidney. With chickens, however, residues in liver were higher than in kidney in both treatment groups.

The residues of mercury in the various tissues of the dosed animals could constitute a hazard to future human consumers. Tissues from control cattle, sheep, and chickens contained no detectable amounts of mercury. (Author abstract reprinted by permission of the American Chemical Society)

73-1936. Lichtenstein, E. P.; Fuhremann, T. W; Hochberg, A. A; Zahlten, R. N; Stratman, F. W. (Dept. of Entomol., Univ. of Wisconsin, Madison, WI 53706). **Metabolism of ^{14}C parathion and ^{14}C paraoxon with fractions and subfractions of rat liver cells.** *J. Agr. Food Chem. 21(3): 416-424; 1973.* (16 references)

To obtain information relative to the metabolism of insecticides in mammalian systems, [2,6-ring-^{14}C]parathion and [2,6-ring-^{14}C]paraoxon were incubated with rat liver cell fractions obtained from the same liver homogenate and with highly purified subfractions from mitochondria and microsomes. Different enzymes in the rat liver were responsible for the degradation and detoxication of parathion and paraoxon. It was primarily with the soluble fractions obtained at 105,000 × *g* and 500,000 × *g* forces that parathion was degraded to water-soluble metabolites (20% of the applied radiocarbon) and only to a lesser extent by microsomes (1% of the applied radiocarbon). Based on analyses of the organic solvent extraction phases, enzyme activities in the soluble fraction resulted in a reduction of parathion to aminoparathion, but also in an oxidation of parathion to paraoxon. Microsomes showed some parathion-degrading activity and the amount of *p*-nitrophenol in the organic solvent phase. The largest amounts of [^{14}C]paraoxon derived water-soluble metabolites (65% of the applied radiocarbon), though, were produced by the soluble fractions which also reduced paraoxon to aminoparaoxon. A biological assay of the water extraction phases from [^{14}C]parathion- or [^{14}C]paraoxon-treated incubation mixtures containing the 105,000 × *g* supernatant did not result in insect mortalities, thus indicating a detoxication of the insecticidal substances. (Author abstract reprinted by permission of the American Chemical Society)

73-1937. Freal, J. J; Chadwick, R. W. (Environ. Protect. Agency, Primate and Pestic. Effects Lab., Perrine, FL 33157). **Metabolism of hexachlorocyclohexane to chlorophenols and effect of isomer pretreatment on lindane metabolism in rat.** *J. Agr. Food Chem. 21(3): 424-427; 1973.* (16 references)

The role of γ-2,3,4,5,6-pentachlorocyclohex-1-ene (γ-PCCH) in the metabolism of lindane (γ-HCH) and the effect of pretreatment with various HCH (BHC) isomers on lindane metabolism were evaluated in this study. Four groups of rats were treated perorally daily with one of four configurational isomers of hexachlorocyclohexane (α-, β-, γ-, or δ-HCH). One group of animals received γ-PCCH. After 1 week of pretreatment, all animals received an oral dose of γ-HCH. The daily urinary excretion of free chlorophenols was analyzed by GLC. While β-HCH was metabolized to 2,4,6-trichlorophenol and γ-PCCH was metabolized to 2,4,5-trichlorophenol, the α- and δ HCH were metabolized to both 2,4,5-, and 2,4,6-trichlorophenol. Rats treated with lindane, however, excreted 2,4,6-, 2,3,5-, and 2,4,5-trichlorophenol, 2,3,4,6- and 2,3,4,5-tetrachlorophenol, and 2,3,4,5,6-pentachloro-2-cyclohexen-1-ol. If γ-PCCH is an intermediate, it is a minor one, and more efficient pathways are involved in the metabolism of lindane. This study also indicates that pretreatment with the isomers of HCH alters the metabolism of lindane in rats. (Author abstract reprinted by permission of the American Chemical Society)

73-1938. Wells, M. R.; Ludke, J. L.; Yarbrough, J. D. (Dept. of Biol., Middle Tennessee State Univ., Murfreesboro, TN 37130). **Epoxidation and fate of ^{14}C-aldrin in insecticide-resistant and susceptible populations of mosquitofish (*Gambusia affinis*).** *J. Agr. Food Chem. 21(3): 428-429; 1973.* (11 references)

One susceptible and two resistant populations of mosquitofish (*Gambusia affinis*) were treated with [^{14}C]aldrin to determine differences in aldrin epoxidation between susceptible and resistant mosquitofish brains and livers. Resistant mosquitofish converted aldrin to dieldrin and/or water-soluble material at a greater rate than susceptible mosquitofish. These data would tend to support rate of detoxification as a possible mechanism of resistance to aldrin in the mosquitofish. (Author abstract reprinted by permission of the American Chemical Society)

73-1939. Hsieh, D. P. H. (Dept. of Environ. Toxicol., Univ. of California, Davis, CA 95616). **Inhibition of aflatoxin biosynthesis [by] dichlorvos.** *J. Agr. Food Chem. 21(3): 468-470; 1973.* (12 references)

Dichlorvos (dimethyl 2,2-dichlorovinyl phosphate) was found to possess a strong inhibitory effect on aflatoxin biosynthesis by *Aspergillus parasiticus* ATCC 15517. At 10 ppm it inhibited 90% of aflatoxin production in three types of liquid media without affecting the fungal growth. When the actively synthesizing cultures were supplemented with 10 ppm of dichlorvos and [1-^{14}C]acetate, a reduced amount of aflatoxin B_1 was produced which contained almost no label from the acetate, suggesting that dichlorvos inhibits an early step in the secondary metabolic pathway for aflatoxin biosynthesis. Experiments with other organophosphorus insecticides showed that dichlorvos was particularly inhibitive to the biosynthesis of aflatoxins. (Author abstract reprinted by permission of the American Chemical Society)

73-1940. Wallnoefer, P. R.; Safe, S.; Hutzinger, O. (Bayerische Landesanstalt fuer Bodenkultur u. Pflanzen-

bau, Munich, Germany). **Microbial hydroxylation of the herbicide *N*-(3,4-dichlorophenyl)methacrylamide (dicryl).** *J. Agr. Food Chem. 21(3): 502-503; 1973.* (5 references)

The fungus *Rhizopus japonicus* converts the herbicide *N*-(3,4-dichlorophenyl)methacrylamide (dicryl) to *N*-(3,4-dichlorophenyl)-2-methyl-2,3-dihydroxypropionamide. This metabolite was formed by the addition of two hydroxyl groups to the ethylenic double bond of dicryl. Its structure was elucidated by nuclear magnetic resonance and mass spectrometric analysis. (Author abstract reprinted by permission of the American Chemical Society)

73-1941. Sethunathan, N.; Yoshida, T.* (Dept. of Soil Microbiol., Int. Rice Res. Inst., Los Banos, Laguna, Philippines). **Parathion degradation in submerged rice soils in the Philippines.** *J. Agr. Food Chem. 21(3): 504-506; 1973.* (10 references)

The persistence of parathion (*O,O*-diethyl *O*-p-nitrophenyl phosphorothioate) in four Philippine rice soils was investigated in submerged and upland conditions. The parathion in the soils after incubation at 30° was extracted with a hexane-acetone mixture and the amount was determined by gas chromatography. The insecticide disappeared more rapidly from submerged soils than from upland soils. In submerged soils parathion was reduced to aminoparathion (*O,O*-diethyl *O*-p-aminophenyl phosphorothioate). Autoclaving of the soils increased the persistence of parathion under submerged conditions, indicating microbial participation in its degradation. Parathion degraded faster in flooded soil inoculated with parathion-hydrolyzing *Flavobacterium* sp. than in uninoculated soil. (Author abstract reprinted by permission of the American Chemical Society)

73-1942. Chin, W. T.; Kucharczyk, N.*; Smith, A. E. (Uniroyal Chem., Div. of Uniroyal Inc., Naugatuck, CN 06770). **Nature of carboxin (Vitavax)-derived bound residues in barley plants.** *J. Agr. Food Chem. 21(3): 506-507; 1973.* (5 references)

More than 70% of the unextractable residue derived from [^{14}C]carboxin (5,6-dihydro-2-methyl-1,4-oxathiin-3-carboxanilide) in barley leaves was liberated by hot dimethyl sulfoxide. The ^{14}C residue so released was identified as carboxin (30%) and its sulfoxide (70%). The theory of lignin complex formation for detoxification through immobilization by plants is further indicated. (Author abstract reprinted by permission of the American Chemical Society)

73-1943. North, H. H.; Menzer, R. E.* (Dept of Entomol., Univ. of Maryland, College Park, MD 20742). **Metabolism of DDT in human embryonic lung cell cultures.** *J. Agr. Food Chem. 21(3): 509-510; 1973.* (23 references)

Cultures of primary human embryonic lung (HEL) cells have been utilized to study DDT degradation. Incubation of ring-^{14}C-DDT for 48 hr with primary HEL cells in monolayer cultures resulted in metabolism of DDT by reductive dechlorination to DDD (38%) and DDA (4%). No other metabolites were found. This pathway is quite similar to that seen in mammals and microorganisms. (Author abstract reprinted by permission of the American Chemical Society)

73-1944. Rumsey, T. S.; Bond, J. (U.S. Dept. Agr., Beltsville, MD 20705). **Effect of aldrin, urea and DES on the physiology of beef heifers fed a concentrate or roughage diet.** *J. Anim. Sci. 35(5): 978-985; 1972.* (22 references)

A 2^4 factorial experiment was designed to test the effects of aldrin, nitrogen source, type of diet, and DES on the physiology of beef heifers. Aldrin fed daily at 1 mg/kg had little effect on heart rate and more effect on the T amplitude in the EKG during the first few months of the study. The QRS interval increased with continuous feeding of aldrin, and the concentration of lactic acid in jugular blood was elevated. Little interaction was noted between aldrin and the other variables studied. The changes observed may indicate a chronic toxicity, but the biological significance of these changes is unknown.

73-1945. Sneva, F. A.; Raleigh, R. J.; Turner, H. A. (Squaw Butte Exp. Station, Burns, OR 97720). **Paraquat-cured herbage for late season grazing.** *J. Anim. Sci. 36(1): 107-113; 1973.* (12 references)

Yearling heifers grazed on paraquat-cured crested wheatgrass in the fall of 1966, 1967, and 1970 increased in weight 0.22, 0.27, and 0.33 kg/day more than those grazed on naturally cured herbage. Total water consumption and forage intake were also greater in these animals. Significantly higher P, K, crude protein, lignin, and ash were recovered from paraquat-cured forage in 5 weeks following treatment, but the total herbage yield was lower. Clearance of paraquat for chemically curing grasses to be grazed is being sought.

73-1946. Furuta, H. (Takeda Chem. Ind., Ltd., Chuo-ku, Tokyo, Japan). **Validamycin (trade name: Validacin) new antibiotic for sheath blight of rice.** *Jap. Pestic. Inform. 15: 28-30; 1973.*

Validamycin, an antibiotic specifically effective for the control of certain plant diseases caused by fungi belonging to *Corticiaceae, Basidiomycetes* has an acute oral LD50 > 20,000 mg/kg in rats and mice. In mice the acute intravenous LD50 is > 13,000 mg/kg and the acute intraperitoneal LD50 is > 10,000 mg/kg. Rabbits exhibited no irritation on eyes and skin after treatment. In an oral 90 day subacute toxicity study no effect was observed with up to 10,000 ppm in the feed of rats and

mice. Estimated LC50s were > 40 ppm for carp and 4,000 ppm for killifish. Parasitic insects and mites were unaffected by up to 100 ppm of the antibiotic, and no phytotoxicity has been observed. The validamycins have a half-life of several hours in humic allophane soil.

73-1947. Brown, R. D.; Nicholson, W. E.; Chick, W. T.; Strott, C. A. (Dept. Med., Vanderbilt Univ. School Med., Nashville, TN 37232). **Effect of *o,p'*-DDD on human adrenal steroid 11 β-hydroxylation activity.** *J. Clin. Endocrinol. Metab. 36(4): 730-733; 1973.* (17 references)

Patients with Cushing's disease treated with *o,p'*-DDD (TDE) had significantly elevated plasma deoxycortisol/cortisol and deoxycorticosterone/corticosterone ratios compared to untreated patients. Ratios of 17-OH-progesterone/deoxycortisol were significantly lower in treated patients than in untreated patients, reflecting increased deoxycortisol levels. The effect of *o,p'*-DDD on 17 α-hydroxylation and 21-hydroxylation could not be evaluated because plasma progesterone was not detectable in most patients. Apparently *o,p'*-DDD inhibits 11β-hydroxylation activity, but not 17 α- or 21-hydroxylation systems.

73-1948. Kulkarni, P. G.; Mitlin, N.; Hurst, G. A. (Dept. of Wildl. and Fish., Mississippi Agr. and Forestry Exp. Sta., Mississippi State MS 39762). **Toxicity of busulfan and influence of ingested chemosterilized boll weevils on reproductive function performance of the Japanese quail.** *J. Econ. Entomol. 66(2): 341-343; 1973.* (13 references)

Busulfan-sterilized males of *Anthonomus grandis* Boheman were released in cotton fields of south Mississippi, Alabama, and Louisiana as part of the boll weevil eradication experiment. Laboratory experiments were conducted on the Japanese quail, *Coturnix coturnix japonica* (Teminek & Schlegel), to assess the effects of the toxicity of busulfan fed, chemosterilized weevils on certain species of wildlife. The acute toxicity of busulfan to quail chicks at age 1 week was 162.7 mg kg. Toxicity for males and females at age 8 weeks was 169.3 and 174.3 mg/kg, respectively. Gland weights of testes and ovaries were affected at LD50 or at a higher dose. Quail chicks were fed chemosterilized weevils. Eggs of these quail and their offspring were analyzed for egg production, fertility, hatchability, shell thickness, albumen, and yolk contents. Chemosterilized weevils had no significant effect on the reproductive performance of *Coturnix* quail. (Author abstract by permission)

73-1949. Charnetski, W. A.; Lichtenstein, E. P. (Dept. of Entomol., Univ. of Wisconsin, Madison, WI 53706). **Penetration and translocation of ^{14}C-lindane in pea plants.** *J. Econ. Entomol. 66(2): 344-349; 1973.* (13 references)

The effects of ^{14}C-lindane concentrations around pea roots on the penetration into roots, its translocation into greens, and the distribution of ^{14}C-lindane between roots, cotyledons, and greens were investigated. In addition, the production of water-soluble metabolites was measured after plants had grown in ^{14}C-lindane-treated nutrient solutions or sand. With increasing concentrations of the insecticide in sand, its penetration and translocation in pea plants reached plateaus when a concentration of 180 ppm in roots and 9 ppm in greens was reached. This corresponded to concentrations of ^{14}C-lindane in sand at 16 ppm and 6 ppm, respectively. The insecticide was mostly concentrated in root tips. Plants growing in ^{14}C lindane-treated nutrient solutions or sand contained 70% of the totally recovered radiocarbon in roots and 6% in the greens after a growing time of 1.5 days. These figures were 25 and 50%, respectively, after 30 days of growing time. A decrease in the amounts of hexane-soluble ^{14}C-compounds and an increase in water-soluble ^{14}C-compounds occurred with time, indicating a metabolism of the insecticide into water-soluble compounds. Plants, after growing in ^{14}C-lindane-treated nutrient solutions for 1.5 days, were also transferred into lindane-free nutrient solutions. Within one day, these plants released close to 60% of their total radiocarbon into this surrounding nutrient solution. This radiocarbon was associated with the hexane extraction phase and was identified by GLC and TLC as primarily lindane. (Author abstract by permission)

73-1950. Anonymous. **Pesticides: a possible link to impotency.** *J. Med. Ass. State Ala. 42(5): 368; 1972.*

West Virginia University researchers feel there is a possible link between pesticide residues and hormonal imbalance, which may lead to impotency. Large amounts of malathion, parathion, and carbaryl administered to various species were found in male reproductive organs. Large amounts of DDT were also found in the testes and seminal plasma, and DDT suppressed some metabolic functions of the prostate gland. No conclusive evidence has shown that genetic damage or irreversible sterility may be caused by these compounds, but pesticide residues have been blamed for impotence among some English farm workers. Increased incidence of fetal abnormalities in laboratory animals has also been attributed to pesticides. Such abnormalities may be caused by altered hormone levels in males and/or females.

73-1951. Woolley, D. E. (Dept. Environ. Toxicol., Univ. California, Davis, CA 95616). **Studies on 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl)ethane (DDT)-induced hyperthermia: effects of cold exposure and aminopyrine**

injections. *J. Pharmacol. Exp. Ther. 184(1): 261-268; 1972.* (17 references)

DDT, administered p.o. at 1000 mg/kg to rats, produced an initial rise, followed by a decrease in tail temperature and a rise in deep body temperature, which reached 42°C at death. The rise in tail temperature definitely occurred before the rise in body temperature. Skin temperatures were not markedly affected. Five hour survival in rats treated with 1200 mg/kg DDT was increased from 36% to 90% and 78%, respectively, with aminopyrine therapy and cold exposure. Mean survival time was greater in aminopyrine- and cold-treated animals dosed with 600 or 1200 mg/kg DDT, but these treatments were not sufficient to counteract the lethal effects of DDT. Aminopyrine administration decreased the temperature of DDT-treated rats, and a definite relation between survival time and last recorded temperature was noted in cold-exposed, DDT-treated animals. DDT-treated rats surviving for a relatively long time in cold exposure seemed to lose ability to retain body temperature, unlike untreated rats exposed to cold for prolonged periods. Cold exposure only altered the effects of DDT in the terminal stages, while aminopyrine reduced the signs of DDT poisoning.

73-1952. Sidell, F. R.; Groff, W. A.; Kaminskis, A. (Clin. Investigation Sect., Biochem. Lab., Edgewood Arsenal, MD 21010). **Toxogonin and pralidoxime: kinetic comparison after intravenous administration to man.** *J. Pharm. Sci. 61(11): 1765-1769; 1972.* (12 references)

The chloride and methanesulfonate salts of pralidoxime administered intramuscularly to human volunteers had the same pharmacokinetic characteristics while obidoxime (toxogonin), a compound of similar structure but twice the size of pralidoxime, had a smaller volume of distribution and a lower renal clearance rate. Plasma concentration versus time curves were almost identical for the obidoxime (1 mg/kg) and the two salts of pralidoxime (5 mg/kg). Recoveries of the 5 mg/kg dose of pralidoxime chloride and methanesulfonate in 24-hour urine were 89.8 and 87.1%, respectively. Of the 0.5 and 1.0 mg/kg toxogonin doses 68.1% was recovered in the urine within 24 hours. These findings explain the five fold difference in plasma concentration observed after similar doses of the oximes were administered.

73-1953. Walsh, G. E. (Environ. Protect. Agency, Gulf Breeze Lab., Sabine Island, Gulf Breeze, FL 32561). **Insecticides, herbicides, and polychlorinated biphenyls in estuaries.** *J. Wash. Acad. Sci. 62(2): 122-139; 1972.* (158 references)

The effects of insecticides, herbicides, and polychlorinated biphenyls (PCBs) on the survival, photosynthesis, behavior, metamorphosis, resistance, and chemical changes in tissues of estuarine organisms are reviewed. Chlorinated hydrocarbons have received much attention in estuarine studies. Laboratory and field experiments have shown that while algae differ in response to different insecticides these phytoplankton probably act as primary concentrators of pesticides in water. Organochlorines have been detected in larger marine plants also. Among the invertebrates crabs and shrimp are most sensitive to insecticides. Marine fish are generally less susceptible to poisoning than some of the other aquatic life. The effect of organophosphates may only last for a few hours while more persistent compounds exert their effect after magnification in the trophic pyramid. Most of the work on herbicides has been in freshwater ecosystems rather than in estuaries. Algae are very sensitive to the substituted urea and triazine herbicides. Detoxification has been demonstrated in vertebrates. PCBs are found in all components of the estuarine ecosystem, and available data strongly suggests concentration in the food chain. PCBs are more acutely toxic to invertebrates than to fishes and have been shown to affect reproduction in birds.

73-1954. Mackenthun, K. M.; Keup, L. E. (Applied Technol. Div., Office Water Programs, Environ. Protect. Agency, Washington, DC). **Water pollution. Freshwater macroinvertebrates.** *J. Water Pollut. Contr. Fed. 44(6): 1137-1150; 1972.* (153 references)

A review of effects of water pollutants on freshwater macroinvertebrates includes results of recent pesticide applications in terms of toxicity and resistance in these organisms. The application of 20 to 40 lb of 2,4-D acid equivalent/acre did not obviously harm plankton benthic invertebrates, or fish or accumulate in the water. The plankton sorbed large amounts of the compound. TFM significantly affected the number of benthic organisms only at 4 mg/l. or more. The number of benthic invertebrate standing crops nearly doubled in enclosures treated with heavy concentrations of silvex. Resistance to insecticides was demonstated in freshwater shrimp. Laboratory toxicity tests did not correlate with results obtained in the study of DDT distribution in a stream in Utah. Dead larvae as well as live accumulated DDT, indicating that physical mechanisms were also active in uptake.

73-1955. Kirsch, E. J.; Etzel, J. E. (Dept. Environ. Eng., School Civ. Eng., Purdue Univ., W. Lafayette, IN). **Microbial decomposition of pentachlorophenol.** *J. Water Pollut. Contr. Fed. 45(2): 359-364; 1973.* (9 references)

A significant release of radioactive carbon dioxide from labeled PCP was obtained in a 24 hour incubation, under nonproliferating conditions, of a mixed microbial culture obtained from soil saturated with PCP and acclimated with increasing concentrations of PCP. Up to 68% of the radioactive PCP carbon was recovered as $^{14}CO_2$ when cells were tested at the peak of activity of the acclimated culture, which was stable between 25 and 42 days. Phenol had no effect on the rate of metabolism

of PCP, but organic nitrogen supplied by addition of nutrient broth, which promoted growth of the organisms, reduced the rate of oxidation of PCP. The rate of $^{14}CO_2$ liberation was proportional to the mass of microorganisms present except at high cell concentrations. The results demonstrate biological attack of PCP resulting in its terminal oxidation under specific laboratory conditions.

73-1956. Anonymous. **Storage and excretion of DDT.** *Med. J. Aust. 2(20): 1099-1100; 1972.* (3 references)

Although DDT is quite persistent and accumulates in the fatty tissue, this accumulation is not irreversible in man and in other animals. DDT intake by American workers has been estimated as 0.016 - 0.199 mg/day although no increase has been observed in the average DDT concentration in human fat for the past 15 years in the U.S., indicating that some elimination has taken place. Two studies with human volunteers have demonstrated that DDT is excreted and that the rate of loss of organochlorines deposited in fat increases markedly with the size of the deposit. Monkeys, dogs, and cats can all eliminate fat-stored DDT at a faster rate than man. A decrease in the use of DDT should eventually lead to a decline in the body stores of DDT in the general population.

73-1957. Joy, R. M. (Dept. Physiol. Sci., School Vet. Med., Univ. California, Davis, CA 95616). **Electrical correlates of preconvulsive and convulsive doses of chlorinated hydrocarbon insecticides in the CNS.** *Neuropharmacology 12(1): 63-76; 1973.* (25 references)

Four stages of effects on electrical activity in the brain were observed after administration of DDT or dieldrin to cats. Low frequency hypersynchrony developed within 1 to 2 minutes of administration; the development of widespread afterdischarge in cortical and thalamic areas followed. Frequently, a period of isolated or multiple spikes of high amplitude developed in all areas of the brain. The final stage was characterized by the development of general seizures, and response of different portions of the brain was observed. The dose of DDT required to produce an equivalent effect was at least 10 times that of dieldrin. Pentobarbital, but not diphenylhydantoin or trimethadione, was effective in terminating seizures. All anticonvulsant agents tested that protected against metrazol also afforded protection against dieldrin in mice.

73-1958. Javaid, M. Y. (Dept. Zool. Univ. Panjab, Lahore, Pakistan). **Effect of DDT on the locomotor activity of Atlantic salmon, Salmo salar, in a horizontal temperature gradient.** *Pak. J. Zool. 4(1): 17-26; 1972.* (9 references)

The frequency of movements of salmon yearlings treated with DDT at 5, 10, 50, and 100 ppb was reduced both in a uniform temperature environment and in a temperature gradient. The amount of activity was maximum at the selected temperature with DDT and minimum without it. Frequency, however, is not a fundamental parameter to be considered in temperature selection, and DDT essentially did not change the basic mechanism of temperature selection as indicated by other parameters. No significant differences appeared in the orientation with respect to the selected temperature region in treated and untreated fish. Both treated and untreated fish exhibited longer movements while going towards rather than away from the selected temperature region.

73-1959. Sjoeden, P. O.; Soederberg, U. (Neurophysiological Lab., Ulleraaker Hosp., Uppsalla, S-750 17 Sweden). **Sex-dependent effects of prenatal 2,4,5-trichlorophenoxy-acetic acid on rats' open-field behavior.** *Physiol. Behav. 9(3): 357-360; 1972.* (20 references)

Male offspring of female rats treated with 2,4,5-T at 100 mg/kg on day 7, 8 or 9 of pregnancy exhibited more ambulancy, had shorter periods of latency, and showed a significantly higher frequency of grooming in the open-field behavior test than male offspring of female controls. No differences were observed in behavior (emotional reactivity or exploration) of female offspring from treated and untreated rats. The dose employed did not cause gross teratologic effects although litter size was reduced and perinatal mortality was greater. It is possible that only the most explorative offspring survived, but this explanation is unlikely since both sexes were not affected.to determine the relative contribution of pre- and post- natal mechanisms to the observed differences in behavior.

73-1960. Eliasson, L.; Hallmen, U. (Dept. Botany, Univ. Stockholm, Lilla Frescati, S-104 05 Stockholm, Sweden). **Translocation and metabolism of picloram and 2,4-D in *Populus tremula*.** *Physiol. Plant 28(1): 182-187; 1973.* (23 references)

In a series of experiments with small aspen plants, labeled 2,4-D and picloram remained primarily on or in leaves treated with the herbicides. With 2,4-D 23.9% of the material was found in the shoot above the treated leaf and 6.4% in the shoot below the treated leaf after 9 days. In picloram-treated plants the values were 16.6 and 5.8. Practically no radioactivity was found in the roots. When 200 μg of unlabeled picloram was applied to leaves of smaller plants than those used above, nutrient solutions contained the herbicide after 24 hours, but little translocation occurred from 24 to 72 hours. Two differences were observed in translocation of the herbicides after absorption through a cut stem surface. A slow but continuous translocation to the roots was observed in 2,4-D treated plants. In picloram-treated plants the highest activity in the roots was observed after one day. The distribution of 2,4-D indicated that it followed the

transpiration stream passively, but the distribution of picloram could not be explained in this way. Both herbicides were converted to water-soluble complexes at a slow rate in the plants.

73-1961. Fleeker, J. R. (Dept. Biochem., N. Dakota State Univ., Fargo, ND 58102). **Removal of the acetate-moiety of 2,4-dichlorophenoxyacetic acid in *Ribes-sativum*.** *Phytochemistry 12(4): 757-762; 1973.* (27 references)

In excised *Ribes sativum* leaves exposed to 2,4-D-1-^{14}C 37.8% of the radioactivity in water-soluble metabolites collected after 10 minutes was in glyoxylic acid. Under the same conditions, exposure to 2,4-D-2-^{14}C yielded 23.0% of the radioactivity in glyoxylic acid. Approximately the same percentage of the radioactivity was found in glycine after exposure to 2,4-D-1-^{14}C. The amount of radioactivity in the two acids did not increase with time in proportion to the total ^{14}C in the water soluble fraction. The results suggest that a C_2 fragment like glycolate or glyoxylate were formed from the cleavage of the herbicide side chain. The possibility that photosynthetic incorporation of $^{14}CO_2$, formed in the metabolism of the 2,4-D side-chain, was a source of the labeled glyoxylate was ruled out: in a 6-hr experiment the distribution of isotope in glyoxylic acid and glycine was different depending on the position of the label used. Incorporation of the side-chain label of 2,4-D-2-^{14}C-4-^{36}Cl into ethanol insoluble plant residue was more efficient than that of the ring-label.

73-1962. Fuchs, A.; Viets-Verweij, M.; De Vries, F. W. (Lab. Phytopathol., Agr. Univ., Binnenhaven 9, Wageningen, The Netherlands). **Metabolic conversion in plants of the systemic fungicide triforine [*N,N'*-bis-(1-formamido-2,2,2-trichloroethyl)-piperazine; CELA W 524].** *Phytopathol. Z. 75: 111-123; 1972.* (9 references)

Preliminary qualitative experiments indicated that the fungicide triforine was not metabolized to other fungitoxic compounds by barley, wheat, Chinese cabbage, cucumber, tobacco, or Vigna bean in 16 days although uptake from the hydroponic medium was rapid. Several non-fungitoxic products were recovered from these plants using labeled triforine for treatment. The products resembled those found in the methanolic standard of triforine but increased in concentration with time in the plants (both healthy and diseased). Piperazine appeared to be the terminal residue. In barley plants triforine uptake reached a maximum in five days. The concentration gradually declined after that time while radioactivity reached a peak at eight days and remained constant.

73-1963. Klekowski, R. Z.; Zvirgzds, J. (Dept. Bioenergetics and Bioproductivity, Nencki Inst. Exp. Biol., Polish Acad. Sci., Pasteura 3, Warsaw 22, Poland). **The influence of herbicide 2,4-D-Na on respiration and survival of *Simocephalus vetulus* (O. F. Mueller) (Cladocera).** *Pol. Arch. Hydrobiol. 18(4): 393-400; 1971.* (8 references)

An inhibition which was not dose dependent was observed in oxygen consumption by mature females of *Simocephalus vetulus* exposed to 2,4-D-Na. A 50% inhibition of oxygen consumption was noted with concentrations of 7.5 m*M* 2,4-D-Na while a level of 1.25 m*M* or 10 m*M* produced 20 to 30% inhibition. A short-lasting, adaptive mechanism is suggested by these results, and survival experiments confirmed this possibility. At a six hour exposure mortality increased noticeably only with 15m*M* 2,4-D-Na while longer exposures resulted in a concentration—dependent mortality. Mortality observed at the longest exposure (48 hours) was believed the result of a synergistic effect of the herbicide and lack of food.

73-1964. Opuszynski, K. (Inst. Inland Fish., Zabieniec near Warsaw, P.O. Piaseczno, Poland). **Temperature preference of fathead minnow *Pimephales promelas* (Rafinesque) and its changes induced by copper salt $CuSO_4$.** *Pol. Arch. Hydrobiol. 18(4): 401-408; 1971.* (13 references)

Exposure to copper sulfate (0.20 to 0.25 mg/l.) significantly reduced the temperature selected in a gradient by fathead minnows acclimated to 10 and 20 °C. Fish acclimated to 20° preferred a mean temperature of 27.3° before and 21.3° after exposure to 0.25 mg/l. copper sulfate. At the lower temperature greater toxicity was observed and the dose was reduced to 0.2 mg/l. Mean temperatures selected before and after exposure to copper sulfate were 24.0° and 20.9°. The unexpectedly higher toxicity observed at the lower temperature was probably due to the fact that at the low temperature less mucus, which can tie up copper ions, is secreted by the fish. This assumption was supported by a secondary experiment. The results are compatible with the theory that the toxicity of copper is mechanical; i.e., a copper-organic compound clogs the gills, hindering respiration.

73-1965. Palmer, M. B.; Britton, W. M.; Howarth, Jr., B. (Poultry Sci. Dept., Univ. of Georgia, Athens, GA 30601). **Influence of high levels of DDT in the diets of laying hens on fertility, hatchability, and chick mortality.** *Poultry Sci. 50(5): 1614-1615; 1971.*

A study was conducted to relate the ingestion of DDT by adult hens to the fertility and hatchability of their eggs and the subsequent survival of the chicks for two weeks after hatching. Body weights were obtained on all chicks surviving at two weeks of age. Three groups of 10 White Leghorn hens (12 months old) were fed a commercial laying ration supplemented with zero (control), 300, or 600 ppm technical grade DDT. After three months of feeding the diets, eggs from each group

were collected and set at weekly intervals for six weeks. Percentage fertility for the zero, 300, and 600 ppm DDT groups were 77%, 60%, and 69% respectively. DDT had no effect on hatchability based on percent hatch of fertile eggs. However, there was 75% mortality by two weeks of age in the chicks hatched from eggs of hens fed 600 ppm DDT. Most of this mortality occurred in the first three days after hatching. Percent mortality at two weeks for the chicks hatched from eggs of hens fed the control diet and 300 ppm DDT diet was 1% and 7%, respectively. All chicks hatched from eggs of hens fed DDT had significantly lower body weights at two weeks of age when compared to the control chicks. (Author abstract by permission)

73-1966. Nelson, J. R.; Wookey, L. E.; Nockels, C. F.; Shutze, J. V. (Dept. of Avian Sci., Colorado State Univ., Fort Collins, CO 80521). **Interaction of vitamin A and dieldrin on mallard liver lipids and biotin content.** *Poultry Sci. 51(3): 747-751; 1972.* (14 references).

The effect of chronic ingestion of a low level of dieldrin (1 mg/kg body weight) was studied on mallards fed a diet either adequate or deficient in vitamin A. No gross symptoms of dieldrin toxicity were observed after twelve weeks on experimental diets. After five weeks marked foot pad keratinization occurred in pesticide-fed ducks. Vitamin A deficient birds had significantly reduced liver weight when compared to the other treatment ducks. There was no effect of feeding pesticide on vitamin A content of the liver, but biotin per gram of liver was significantly ($P<0.05$) lower in the pesticide-fed ducks than in the nonpesticide-fed birds. Liver fatty acid composition was altered either by pesticide ingestion or vitamin A deficiency. There were significant ($P<0.05$) accumulations of stearic and palmitic acids with a comparable reduction of their monoenoic derivatives in the dieldrin-fed ducks when vitamin A was adequate in the diet. There were higher levels of long chain polyunsaturated fatty acids (18:2, 18:3, and 20:4) in the dieldrin-fed birds when vitamin A was deficient. Ingestion of dieldrin at this level had a marked depressant effect on liver biotin content and altered fatty acid composition possibly by interference in enzyme systems involved in lipid metabolism. (Author abstract by permission)

73-1967. Lillard, D. A.; Noles, R. K. (Dept of Food Sci. and Poultry Sci., Univ. of Georgia, Athens, GA 30601). **Effect of force molting and induced hyperthyroidism on the depletion of DDT residues from the laying hen.** *Poultry Sci. 52(1): 222-228; 1973.* (12 references)

Experiments were conducted to determine the relationship between dosage levels of DDT and retention of residues in the egg and depot fat of hens, to determine if force molt by feed restriction would increase the rate of elimination of DDT from egg and tissue; and to determine if hyperthyroidism induced by feeding thyroxine would increase the rate of elimination of DDT from the egg or tissue of the hen. Hens which consumed 20, 30, and 40 ppm DDT of daily feed uptake for five days stored the DDT in their depot fat. Concentrations of residues in eggs were approximately 25 to 30 percent of residue concentrations found in the depot fat. Depletion of DDT residues from the eggs and depot fat of hens follows the kinetics of a first order reaction. Also, the depletion rate constant does not depend upon the concentration of residues present in the fat. The half-lives of DDT residues in depot fat and eggs were 7.3 and 7.6 weeks, respectively. When hens were force molted by starvation, half-lives of DDT residues for depot fat and eggs decreased to 5.9 and 5.0. Feeding of 0.45 mg/day of thyroxine for 71 days significantly decreased the half-life of residues in depot fat to about 2.5 weeks and in eggs to 3.8 weeks. Force molting in combination with the thyroxine feeding did not improve the half-lives of DDT residues over feeding thyroxine alone. (Author abstract by permission)

73-1968. Lillie, R. J. (Anim. Sci. Res. Div., Agr. Res Serv., Agr. Res. Cent., Beltsville, MD 20705). **Studies on the reproductive performance and progeny performance of caged White Leghorns fed malathion and carbaryl.** *Poultry Sci. 52(1): 266-272; 1973.* (15 references)

Caged White Leghorn pullets were fed a breeder diet supplemented with 0, 250, or 500 ppm malathion and/or carbaryl. The traits studied in a 36-week period were body weight changes, egg production, egg weights, specific gravity of eggs, feed consumption, mortality, fertility, hatchability, embryonic abnormalities, and progeny performance. In the progeny performance studies, progeny from hens fed 0 and 500 ppm malathion and/or carbaryl were fed a broiler diet supplemented with 0 or 500 ppm malathion or carbaryl for a 4-week period in batteries. The only significant differences resulting from malathion and/or carbaryl supplementation in the feed were pullet weights and 4-week progeny weights. The pullet weight gains were significantly reduced at the 1% level by carbaryl with or without malathion. A significant growth depression was observed with the progeny fed carbaryl, irrespective of maternal diet. In a separate 4-week study the incorporation of 500 ppm malathion and/or carbaryl in the caged Leghorn male diet exerted no significant changes in the fertility pattern or the incidence of sperm and embryonic abnormalities. (Author abstract by permission)

73-1969. Mason, R. W. (Toxicol. Res. Unit, Med. Res. Council, Dunedin, New Zealand). **The binding of some chlorophenoxy acids to bovine serum albumin in vitro.** *Proc. Univ. Otago Med. School 50(3): 61-63; 1972.* (8 references)

The binding of seven chlorophenoxy acids to bovine serum albumin, in vitro, was investigated, and the

order of increasing binding strength was MCPP, 2,4-D, MCPA, 2,4,5-T, 2,4,5-TP, MCPB, and 2,4-DB. The binding strength and the calculated partition coefficients of the benzene moieties increased with increasing substitution in the benzene ring. Interaction between the cationic group of a binding site and the carboxyl group of the acid followed by a strong hydrophobic interaction between the benzene ring of the acid and a proposed nonpolar binding site containing tryptophan is suggested. Separation of the ether oxygen by three methylene groups in butyric acid derivatives allows for better interaction with the distant ionic group than the separation by one methylene group in the acetic acid derivatives. Differences in the binding strengths of 2,4-DB and MCPB are not understood.

73-1970. Uesugi, Y. (National Inst. of Agr. Sci., Min. of Agr. and Forestry, Tokyo, Japan). **[Pharmacology of organophosphorus fungicides.]** *Shokubutsu Boeki (Plant Protect.) 26(3): 103-107; 1972.*

The chemical structures of organophosphate insecticides and organophosphate fungicides are compared and the differences in mechanisms of toxicity are discussed using Kitazin P (EBP) and Inezin (ESBP) as examples. The insecticides inhibit insect cholinesterase, and the fungicides inhibit the dehydrogenase activity of fungi. Although their chemical structures differ, their stabilities are approximately the same. The degradation of the organophosphate fungicides in living organisms and under ultraviolet radiation is rapid. The metabolic products formed have much lower fungicidal activity than the original chemicals. Organophosphates sprayed on rice plants degrade or wash away rather quickly; the half-life is usually one to three days. Hinosan does not translocate appreciably in the rice plant, but Kitazin P does. Kitazin P in a growing rice plant reaches a maximum concentration in a short time and maintains that level for more than 10 days. When the grains are forming, the concentration maximum is not reached until 10 days after spraying. Losses of organophosphates from rice plants occur mostly via dissolution in water or volatilization. The residues of Hinosan and Kitazin P at harvest in rice plants after the usual treatment are negligible, but are slightly higher when the chemicals are sprayed on the water surface of the rice paddy. At this stage thiol residues are almost nonexistent.

73-1971. Bancroft, R.; Prahlad, K. V.* (Dept. Biol. Sci., Northern Illinois Univ., DeKalb, IL 60115). **Effect of ethylene bis [dithiocarbamic acid] disodium salt (nabam) and ethylene bis [dithiocarbamato] manganese (maneb) on *Xenopus laevis* development.** *Teratology 7(2): 143-150; 1973.* (25 references)

Minute doses of the fungicides nabam and maneb affected the development of amphibian embryos. *Xenopus laevis*, 11 hours old and exposed to maneb at 0.1 to 5 ppm, exhibited a retardation in growth after one day and lacked pigmentation present in controls after two days. Melanophores developed later in treated embryos, but they did not have the same pattern as those of controls. A shortened tail and wavy notochord were observed, and swimming was not normal at higher concentrations. Histological examination revealed a decrease in melanin content of the melanosomes in the pigmented retina. The notochord was larger in diameter and the intestinal wall was thicker in treated embryos. Nabam, tested at 1 to 3 ppm, induced only waviness of the notochord and punctate melanophores.

73-1972. Ecobichon, D. J.; Comeau, A. M. (Dept of Pharmacol., Dalhousie Univ., Halifax, Nova Scotia, Canada). **Pseudocholinesterases of mammalian plasma: physicochemical properties and organosphosphate inhibition in eleven species.** *Toxicol. Appl. Pharmacol. 24(1): 92-100; 1973.* (36 references)

The electrophoretic patterns, optimum pH, substrate specificity, *Km* values, rates of substrate hydrolysis and sensitivity to inhibition by DFP, paraoxon, and DDVP were compared for the plasma pseudocholinesterases of the horse, man, mouse, guinea pig, dog, cat, rat, rabbit, swine, goat, and hamster. The molecular heterogeneity of these enzymes was established. There were no significant differences in activity between sexes of the same species, except in the rat where the female had 4- to 10-fold higher activity than the male. Data presented as I50 values for the anticholinesterases showed that DFP was the most potent, paraoxon and DDVP being 10-fold and 100-fold less potent, respectively. With the exception of the rabbit, goat, hamster, and swine, which were very resistant to DFP, the inhibitor I50 values were quite similar despite the marked species variations in enzyme activity and specificity. (Author abstract by permission)

73-1973. Hart, M. M.; Reagan, R. L.; Adamson, R. H. (Lab. of Chem. Pharmacol., Nat. Cancer Inst., Nat. Inst. of Health, Bethesda, MD 20014). **The effect of isomers of DDD on the ACTH-induced steroid output, histology, and ultrastructure of the dog adrenal cortex.** *Toxicol. Appl. Pharmacol. 24(1): 101-113; 1973.* (19 references)

The effect of three geometric isomers of DDD (TDE) on ACTH-induced steroid production, histology, and ultrastructure of the dog adrenal cortex were examined. When administered iv, equal doses of all three compounds eventually inhibited ACTH-induced steroid production. The order of onset of inhibition was *m,p'*-DDD > *o,p'*-DDD > *p,p'*-DDD with the inhibition reaching 50% of control values at 27 min, 87 min and between 4-18 hr, respectively. Histologic examination of the various zones of the adrenal cortex showed minimal effects, from any of the isomers, on the zona glomerulosa at times when the internal structure and spacial arrangement of the cells of the zona fasciculata and reticularis were markedly disrupted. Electron micro-

graphs revealed that these DDD isomers exhibited very minimal effects on the mitochondria of the zona glomerulosa. On the other hand, the mitochondria of the zonas fasciculata-reticularis underwent progressive swelling, dissolution, and eventual rupture following DDD treatment. The order of onset of histologic and ultrastructural effects was *m,p'*-DDD > *o,p'*-DDD > *p,p'*-DDD. However, for each isomer the ultrastructural damage was detected prior to the observation of histologic lesions. Thus, there was a marked temporal correlation between the percentage inhibition of ACTH-induced steroid production, the disruption of normal cellular structure and arrangement in the innermost zones of the adrenal cortex, and the severity of the DDD-induced mitochondria damage in the cells of the zonas fasciculata-reticularis by each of the three isomers of DDD. (Author abstract by permission).

73-1974. Lech, J. J. (Dept. of Pharmacol., Med. Coll. of Wisconsin, Milwaukee, WI 53233). **Isolation and identification of 3-trifluoromethyl-4-nitrophenyl glucuronide from bile of rainbow trout exposed to 3-trifluoromethyl-4-nitrophenol.** *Toxicol. Appl. Pharmacol. 24(1): 114-124; 1973.* (15 references)

A polar ^{14}C metabolite was purified from bile of rainbow trout exposed to ^{14}C (ring-UL) 3-trifluoromethyl-4-nitrophenol (TFM). Analysis by thin-layer chromatography, uv-visible and infrared spectroscopy, gas chromatography, β-glucuronidase hydrolysis, and mass spectroscopy indicated that the material was the glucuronide conjugate of unchanged TFM. The amount of metabolite isolated from the bile of eight 125-g fish represented the conversion of approximately 3% of the total amount of TFM in the tank water in 24 hr. (Author abstract by permission)

73-1975. Wells, M. R.; Yarbrough, J. D. (Dept of Zool., Mississippi State Univ., State College, MS 39762). **In vivo and in vitro retention of ^{14}C aldrin and ^{14}C dieldrin in cellular fractions from brain and liver tissues of insecticide-resistant and susceptible *Gambusia*.** *Toxicol. Appl. Pharmacol. 24(2): 190-196; 1973.* (13 references)

Aldrin and dieldrin-resistant and susceptible populations of mosquitofish (*Gambusia affinis*) were assayed for aldrin and dieldrin retention in particulate fractions of livers and brains following in vivo and in vitro treatment with [^{14}C]aldrin and [^{14}C]dieldrin. In the in vivo studies there was a highly significant difference in retention between all particulate fractions of susceptible and resistant fish brains. In the in vitro studies the corresponding difference was less or entirely absent. This study offers indirect evidence for a membrane barrier to both aldrin and dieldrin in the brains of resistant fish. (Author abstract by permission)

73-1976. Makita, T.; Hashimoto, Y.; Noguchi, T. (Bio-Med. Res. Div., Nisso Inst. for Life Sci., Nippon Soda Co. Ltd., Oiso, Kanagawa, Japan). **Mutagenic, cytogenetic, and teratogenic studies on thiophanate-methyl.** *Toxicol. Appl. Pharmacol. 24(2): 206-215; 1973.* (27 references)

Graded single doses of thiophanate-methyl (8-500 mg/kg) were injected ip into male mice, which were then mated with untreated females over a subsequent 8-week period. Thiophanate-methyl administered to male mice acutely produced no mutagenic effect in the dominant lethal assay, as measured directly by increased early fetal deaths or indirectly by increased preimplantation losses. In rats injected with this chemical there was no direct relation between dosage levels and percentage of spermatogonial and bone marrow cells showing chromosomal breaks. Thiophanate-methyl was given po (1000, 500, 200, and 40 mg/kg/day) to pregnant mice from day 1 to day 15 of gestation. The highest dosage level effected a small difference in the number of living fetuses from the control group but the other groups dosed with 500 mg/kg/day or less presented no differences in implantation sites, number of living fetuses, body weight of living fetuses and number of dead fetuses from the control group. Investigation of cleared skeletons showed no significant difference in the incidence of malformations in all treated groups as compared to the control group. It is concluded that thiophanate-methyl did not exert significant mutagenic, cytogenic and teratogenic effects under the present experimental conditions. (Author abstract by permission)

73-1977. Bhatia, S. C.; Sharma, S. C.; Venkitasubramanian, T. A. (Dept. of Biochem., Vallabhbhai Patel Chest Inst., Univ. of Delhi, Delhi-7, India). **Effect of dieldrin on hepatic carbohydrate metabolism and protein biosynthesis in vivo.** *Toxicol. Appl. Pharmacol. 24(2): 216-229; 1973.* (57 references)

The effects of a single dose of dieldrin (30 mg/kg po) on several parameters associated with hepatic glycogen metabolism, gluconeogenesis, and protein biosynthesis were studied in male albino rats. The result suggested that dieldrin-induced accumulation of hepatic glycogen was brought about by a stimulation of the synthetic pathway coupled with a decreased breakdown of the polysaccharide. The increased incorporation of ^{14}C-labeled glycine and bicarbonate into hepatic glycogen and elevated activities of aminotransferases, pyruvate carboxylase, and fructose-1,6-diphosphatase indicate stimulation of gluconeogenesis by dieldrin. The in vivo incorporation of [1-^{14}C]leucine into microsomal protein was significantly elevated, suggesting the induction of hepatic enzyme protein by the insecticide. (Author abstract by permission)

73-1978. Springfield, A. C.; Carlson, G. P.; DeFeo, J. J. (Dept. of Pharmacol. and Toxicol., Coll. of Pharm., Univ. of Rhode Island, Kingston, RI 02881). **Liver**

enlargement and modification of hepatic microsomal drug metabolism in rats by pyrethrum. *Toxicol. Appl. Pharmacol. 24(2): 298-308; 1973.* (21 references)

Oral administration of pyrethrum to male rats at 200 mg/kg for 23 days resulted in liver enlargement with decreases in hepatic DNA concentrations. While total lipid concentrations were increased significantly, the increases did not account for the enlargement. Protein concentrations of whole liver homogenates, 9000 *g* supernatants and the 105,000 *g* pellet were not different from controls. No significant changes occurred in hepatic water concentrations. Significant decreases in hexobarbital-induced hypnosis without concomitant changes in barbital-induced hypnosis suggested a pyrethrum-caused alteration in hepatic drug metabolism. The activities of hepatic microsomal enzymes responsible for EPN detoxification, *p*-nitro-anisole demethylation, and hexobarbital oxidation were increased to 150, 173, and 241% of control, respectively. No significant increases were noted in the demethylation of aminopyrine or oxidation of L-tryptophan. Increases in liver weight, the detoxification of EPN, and demethylation of *p*-nitroanisole were dose-related. Small increases in enzyme activities were observed at the lowest dose used of 85 mg/kg/day for 15 days. At a daily dose of 500 mg/kg/day liver weights and enzyme activities were increased up to 17 days of treatment but returned to control level within 7 days after cessation of treatment. NADPH cytochrome *c* reductase activity and P-450 concentration were also increased. At high dose levels, pyrethrum will cause induction of microsomal enzymes. (Author abstract by permission)

73-1979. Budreau, C. H.; Singh, R. P. (Dept. of Anatomy, Univ of Western Ontario, London, Ontario, Canada). **Teratogenicity and embryotoxicity of demeton and fenthion in CF-1 mouse embryos.** *Toxicol. Appl. Pharmacol. 24(2): 324-332; 1973.* (27 references)

Demeton administered as a single intraperitoneal dose of 7 or 10 mg/kg, or as three consecutive doses of 5 mg/kg each to CF-1 mice between days 7 and 12 of gestation was found to be embryotoxic with only mild teratogenic potential. Decreased fetal weight and slightly higher mortality of the young were the main embryotoxic effects. Similar results were obtained with 40 and 80 mg/kg of fenthion. Consecutive treatment showed less embryotoxic effects. With either compound an increased dosage generally resulted in further decrease in fetal weight with no increase in the number of abnormalities. High dosages of demeton (10 mg/kg) or fenthion (120-160 mg/kg) administered on days 8, 9, or 10 of gestation had no effect on litter size at birth or on the survival rate of the young. Demeton treatment on day 10 resulted in a significantly lower growth rate of the young. The results did not show any correlation between the potency of the cholinesterase inhibitor and teratogenicity. The safety of fenthion as a potential insecticide was evaluated. (Author abstract by permission)

73-1980. Worden, A. N.; Wheldon, G. H.; Noel, P. R. B.; Mawdesley-Thomas, L. E. (Huntingdon Res. Cent., Huntingdon PE18 6ES, England.) **Toxicity of gusathion for the rat and dog.** *Toxicol. Appl. Pharmacol. 24(3): 405-412; 1973.* (8 references)

Gusathion (azinphosmethyl) was subjected to toxicity studies lasting two years in rats and dogs. In the rat study a dietary concentration of 50-100 ppm gusathion (approximately 5-10 mg/kg body weight/day) was tolerated without adverse effect upon growth, food consumption, renal function, hematopoiesis, or survival, although convulsive episodes were recorded for some females, and blood plasma and erythrocyte and brain cholinesterase values were depressed. In terms of cholinesterase inhibition the 5 ppm and 2.5 ppm were virtually no effect levels. In the dog study an effect level was eventually obtained when the dietary concentration of gusathion for the high-level group had been raised stepwise from an initial 50 ppm, abnormal signs following almost immediately when the level was changed from 150 ppm (approximately 5 mg/kg/day) to 30 ppm (approximately 10 mg/kg/day). There was only a slight depression of cholinesterase after feeding at 50 ppm for a year. No organ damage that could be attributed to gusathion was found at any dose level in either species. (Author abstract by permission)

73-1981. Korn, S. (Nat. Mar. Fish. Serv., Tiburon Fish. Lab., Tiburon, CA 94920). **The uptake and persistence of carbaryl in channel catfish.** *Trans. Amer. Fish. Soc. 102(1): 137-139; 1973.* (7 references)

Channel catfish exposed to 2.8 mg/kg/wk carbaryl in the feed accumulated 9 ng/g of carbaryl and its metabolites during the 56-day experiment. Residue accumulation over the same period due to exposure to 0.25 mg/l. in the bath was 11 ng/g. An accumulation of 1 and 2 ng/g, respectively, was observed with 0.28 mg/kg per wk in the diet and 0.05 mg/l. in the bath. Fish contained 1% of the available pesticide in diet studies and 0.0001% in bath studies. After a 28-day withdrawal period, 22% of the residue remained in fish from the diet study and 89% of the residue remained in fish exposed via the water. The difference was probably due to conversion of carbaryl to α-naphthol, which is more persistent, in the water. Based on a maximum application rate of 4.6 kg/hectare over a one meter pond, appreciable residue accumulation in channel catfish is not likely. However, further research on persistence of α-naphthol is required.

73-1982. Hughes, J. P. W. (Author address not given). **Investigations into the biological effects of organophosphorus compounds.** *Trans. Soc. Occup. Med. 22(4): 134-136; 1972.* (9 references)

Organophosphates may lower ChE enough to cause immediate symptoms and later ataxia and paralysis. Tri-aryl phosphates have caused ataxia and paralysis, sometimes accompanied by transient signs of

ChE inhibition. A phenyl group in the ortho position seems to be characteristic of those compounds having neurotoxic effects but little or no anti-AChE effect. Experimental animals vary in their sensitivity to tri-aryl phosphates, and at least two different species, such as chickens and cats, should be used for testing. In man a slight decrease in plasma ChE levels is sufficient indication of exposure to tri-aryl phosphates to suggest withdrawal from the source. Treatment with atropine or other drugs is generally not required. Exposure to other organophosphate insecticides often requires prompt treatment with atropine and oximes, which are only effective before the aging of phosphorylated enzymes occurs.

73-1983. Poloz, D. D.; Lapushkov, A. G. (All-Union Inst. Exp. Vet., Moscow, USSR). **Antidotnaya effektivnost' atropina, tropatsina i dipiroksima pri otravlenii zhivotnykh khlorofosom. [Effectiveness of atropine, tropazine, and dipyroxime as antidotes in trichlorfon poisoning of domestic animals.]** *Veterinariya (Moscow) 47(6): 68-69, 1970.* (Russian)

The effectiveness of atropine, tropazine, and dipyroxime as cholinesterase inhibitor antidotes was studied in albino mice, rabbits, piglets, and sheep to which 600, 180, 650, and 450 mg/kg b.w. of trichlorfon was administered s.c. The animals developed clinical symptoms of poisoning (irritability, motor discoordination, tremor of the skeletal muscles, sialorrhea, bronchial spasm, cyanosis, paresis, paralysis) in 7-10 minutes after poisoning. All animals in the control group died in 5 to 7 hours. Judged by the antidote action speed and the rate of recovery, a mixture of 15 mg of dipyroxime with respectively 5 and 10 mg of tropazine per kg of body weight for piglets and sheep as well as for mice and rabbits was most effective. The antidote effect developed 2-3 minutes following i.m. injection; complete recovery was observed in all animals in 2-3 days. Combinations of atropine with dipyroxime had similarly high effectiveness in all animals except sheep.

73-1984. Trifonova, T. K.; Gladenko, I. N.; Shulyak, V. D. (Ukrainian Sci. Res. Inst. Exp. Vet., Kiev, USSR). **Deystviye gamma-izomera GKhTsG i sevina na polovuyu funktsiyu. [Effect of gamma-BHC and Sevin on reproduction.]** *Veterinariya (Moscow) 47(6): 91-93; 1970.* (Russian)

The reproductive functions of female rats daily fed 5 mg of γ-BHC (lindane) or Sevin (carbaryl) per kg for 90 days or 10 mg of γ-BHC or Sevin per kg for 138 days were studied. Unlike γ-BHC Sevin fed in doses of 5 mg/kg reduced the rate of fertilization after the poisoning test. However, the numbers of corpora lutea per animal were within normal limits in both groups. The litters from the test animals were larger than those from the control group, and no teratogenic effects of either Sevin or γ-BHC were observed. A considerable reduction of fecundity and litter size was observed in rats daily fed 10 mg of Sevin or γ-BHC for 138 days. Pesticide residues were detected in embryos.

73-1985. Grishchenko, L. I. (All-Union Inst. Exp. Vet., Moscow, USSR). **Patomorfologicheskiye izmeneniya pri otravlenii ryb pestitsidami. [Pathomorphological changes in pesticide-poisoned fish.]** *Veterinariya (Moscow) 47(12): 62-63; 1970.* (Russian)

Pathomorphological-histological changes were studied in carp exposed to methylnitrophos (fenitrothion), phosphamide (dimethoate), and trichlorometaphos-3 (ronnel) in acute, subacute, and chronic poisoning tests for 1-4, 12-14, and 25-30 days, respectively. The LD50 values of methylnitrophos, phosphamide, and trichlorometaphos were 15 mg/l., 40.3 mg/l., and 200 mg/l. The concentrations used for subacute and chronic tests equaled 1/3-1/15 and 1/5-1/25 of the corresponding LC50 values. Pale gills, plethora of the inner organs and cerebral membrane vessels with hemostasis in the cerebral matter, focal hyperemia of the liver, and general anemia were determined on autopsy. Methylnitrophos and trichlorometaphos caused edema of the gills, separation, and dystrophy. Necrosis of the respiratory epithelium possibly with desquamation, karyopyknosis and pigmentation of reticulohistiocytes in the pancreas, increased reticulohistiocyte count in the spleen pulp, and deformation with dense, colored, or vacuolized cytoplasm of the nerve cells of the hypothalamus and the medulla oblongata were determined, especially in acute and subacute poisoning. Poisoning with phosphamide caused only hemodynamic troubles in the brain and inner organs, edema of the gills, and granular dystrophy and deformation of the liver cells. Dysfunction of the central and sympathetic nervous systems and local toxic effect on the gill tissue were the most serious consequences of poisoning with the tested pesticides.

See also **73-1786** **73-1825** **73-1827** **73-1828** **73-1840** **73-1991** **73-1992** **73-1993**

73-1986. Blagg, A. H.; Rawls, J. L. (Bureau Surveillance, Special Anal. Lab., Florida State Dept. Pollut. Contr., FL). **GLC analysis of carbamate pesticides and phenolic compounds in water.** *Amer. Lab. 4(12): 17-20; 1972.* (1 reference)

A simple GC method has been developed for determining *N*-methylcarbamates and phenolic compounds at levels below 1 ppb in water samples. The procedure is based on recent work in which the ester linkage of *N*-methylcarbamates was cleaved and reacted with 2,5-dichlorobenzenesulfonyl chloride, resulting in the formation of strongly electron-capturing derivatives. Samples were concentrated using a methylene chloride extraction if levels were $<$ 10 ppb or used directly if levels were $>$ 10 ppb. The reagent was introduced along with K_2CO_3 buffer and allowed to react at 80° for about 15 min. The products were extracted into 1 ml of hexane-ether and analyzed on a GC equipped with a ^{63}Ni high-temperature electron capture detector and a flame photometric detector. Carbaryl derivatives gave about five times the response of Baygon (propoxur) derivatives.

73-1987. Thornburg, W. (Del Monte Corp. Res. Cent., Walnut Creek, CA 94598). **Pesticide residues.** *Anal. Chem. 45(5): 151R-167R; 1973.* (411 references)

Readily available information on pesticide methodology published between November 1970 and November 1972 and useful to the residue analyst is reviewed. New detectors and packing materials, as well as reliable automatic injection devices, have contributed to the improvement of GC analysis of pesticide residues. Completely automatic extraction, purification, and quantitation instrumentation is still not available, but this technique continues to be one of the most satisfactory. Although organochlorines are being replaced by other pesticides, they continue to appear in environmental samples and new methods are still being developed for their determination. Phosphorus-specific thermionic detectors and flame photometric phosphorus and sulfur specific detectors remain the most useful tools for the determination of organophosphorus compounds. Multi-halogenated acetate derivatives of carbamates have solved many problems of instability of these compounds on GC columns. TLC, column chromatography, spectrophotometry, GC, and many other techniques have been used in the analysis of herbicides, many new fungicides, and acaricides.

73-1988. Baker, P. B.; Hoodless, R. A. (Dept of Trade and Ind., Lab. of the Govt. Chem., Cornwall House, London, SE1 9NQ, England). **Fungicide residues. The determination of residues of binapacryl in selected fruits by gas chromatography.** *Analyst 98(1164): 172-175; 1973.* (11 references)

A simple method for determining residues of binapacryl in selected fruits is presented. After extraction with a mixture of hexane, diethyl ether and dimethylformamide, binapacryl is separated from interfering co-extractives by chromatography on a silica gel column and is quantitatively determined by electron-capture gas-liquid chromatography. A confirmatory chemical test for binapacryl is also described.(Author abstract by permission)

73-1989. Machin, A. F.; Quick, M. B.; Waddell, D. F. (Chem. Dept., Min. of Agr., Fish. and Food, Cent. Vet. Lab., New Haw, Weybridge, Surrey, England). **Rapid determination of the organophosphorus pesticides diazinon and dichlorvos in blood by gas chromatography.** *Analyst 98(1164): 176-180; 1973.* (9 references)

A rapid method for the gas-chromatographic determination of diazinon and dichlorvos in blood is described. Protein is precipitated by mixing the blood with an excess of acetone containing an internal standard, and the supernatant liquid is injected, directly or after concentration, into the gas chromatograph. A thermionic phosphorus detector is used. Recoveries are satisfactory from 0.1 ml of blood containing 0.1 ppm of the pesticide without concentration of the extract. If a 1-ml sample is used and the extract concentrated, 0.02 ppm can be determined. It is suggested that the method should be applicable to a wide range of organophosphorus pesticides. This method is also shown to be effective for determining diazinon in tissues and organs, but it is not recommended for this purpose. (Author abstract by permission)

73-1990. Webber, T. J. N.; Box, D. G. (Shell Res. Ltd., Woodstock Agr. Res. Cent., Sittingbourne, Kent, England). **The examination of tetrachlorvinphos and its formulations for the presence of tetrachlorodibenzo-*p*-dioxins by a gas-liquid chromatographic method.** *Analyst 98 (1164): 181-189; 1973.* (19 references)

A gas-chromatographic method for the examination of the insecticide tetrachlorvinphos for the presence of tetrachlorodibenzo-*p*-dioxins is described. Procedures are described both for the extraction and clean-up of the sample and for the final analysis to determine tetrachlorodibenzo-*p*-dioxins down to 0.025 ppm or less by gas-liquid chromatography with electron capture detection. Tetrachlorodibenzo-*p*-dioxins were not detected in various samples of tetrachlorvinphos and its formulations, either before or after accelerated storage for two weeks at 55°C. (Author abstract by permission)

73-1991. Bogusz, M.; Borkowski, T. (Inst. of Forensic Res., Westerplatte 9, Krakow, Poland). **The application of the thin-layer chromatographic-enzyme inhibition technique to organochlorine insecticides.** *Analyst 98(1164): 190-193; 1973.* (11 references)

The application of the thin-layer chromatographic-enzymatic technique to lindane, *p,p'*-DDT, methoxychlor, heptachlor, aldrin, dieldrin, and endrin has been investigated. By use of this technique, lindane in amounts of 500 ng or more is detected, whereas the other pesticides tested remain undetected up to 10 μg. Positive results for the tests for organophosphorus and carbamate pesticides with the thin-layer chromatographic-enzymatic technique therefore require corroboration from other tests to exclude the possibility of the presence of lindane. Kinetic enzymatic studies have shown that lindane is a non-competitive inhibitor of carboxylesterase, the predominant enzyme of liver homogenate, which is responsible for the hydrolysis of a chromogenic substrate. Lindane does not inhibit the cholinesterase in liver homogenate. (Author abstract by permission)

73-1992. Beynon, K. I.; Elgar, K. E.; Mathews, B. L.; Wright, A. N. (Shell Res. Ltd., Woodstock Agr. Res. Cent., Sittingbourne, Kent, England). **The analysis of crops to determine neutral conjugates of an *N*-hydroxymethyl derivative of monocrotophos insecticide.** *Analyst 98(1164): 194-201; 1973.* (6 references)

Following the application to plants of the organophosphorus insecticide monocrotophos (azodrin; dimethyl *cis*-1-methyl-2-methylcarbamoylvinyl phosphate), an *N*-hydroxymethyl derivative can sometimes be detected as a breakdown product. This product is capable of conjugation with plant sugars, and the present paper describes the development of an analytical method for the determination of this conjugate. In the laboratory the conjugate can be converted into a complex mixture of enzyme inhibitors by reaction with hydrochloric acid. However, if the reaction is carried out in the presence of butane-2-thiol, the reaction can be controlled, and there is quantitative conversion into an *s*-butyl thioether. This derivative can be determined down to a level of 0.03 ppm by a cholinesterase inhibition technique, and added specificity can be obtained by carrying out the inhibition reaction directly on a thin-layer plate after chromatography. The verification of the procedure by using radioisotope techniques is described. (Author abstract by permission)

73-1993. Bradway, D. E.; Shafik, T. M. (Perrine Primate Lab., Environ. Protect. Agency, P.O. Box 490, Perrine, FL 33157). **Parathion exposure studies. A gas chromatographic method for the determination of low levels of *p*-nitrophenol in human and animal urine.** *Bull. Environ. Contam. Toxicol. 9(3): 134-139; 1973.* (7 references)

A method which gave recoveries from 88 to 97% was developed for the determination of low levels of *p*-nitrophenol (PNP) in human and rat urine. PNP contained in urine was extracted in ether, hydrolyzed under acid conditions, extracted into benzene, derivatized with diazoethane, and applied to a silica gel column for cleanup. The fraction containing the ethyl ether derivative of PNP was analyzed by electron capture GC. The limits of detection were 0.05 ppm for rat urine and 0.02 ppm for human urine. PNP excretion in rats given parathion for 12 days at 1/10 and 1/100 LD50 differed considerably from that of total alkyl phosphates. Initially, the PNP excretion rate was more than twice that of the alkyl phosphates, reaching a maximum at about the third day. It declined steadily after the third day and was lower than that of the alkyl phosphates after 10 days. A constant excretion rate was observed with the alkyl phosphates for the entire experiment. Higher molecular weight ethers of PNP may be used to provide confirmation of PNP through the same procedure.

73-1994. Cranmer, M. F.; Copeland, M. F. (Nat. Cent. Toxicol. Res., Pine Bluff Arsenal, Jefferson, AR 72079). **Electron capture gas chromatographic analysis of DDT: utilization of 2-chloroethanol derivative.** *Bull. Environ. Contam. Toxicol. 9(3): 186-192; 1973.* (2 references)

The 2-chloroethanol derivative was utilized in a GC determination of *p,p'*-DDA and was 3.7 times more responsive to electron capture detection than the methyl ester of DDA. It also produced a retention time which separated DDA from other organochlorines possibly interfering with the analysis. The esterification was carried out with BCl_3-chloroethanol in a steam bath for 30 minutes. The efficiency of the conversion, as measured gravimetrically, was 91.5%. When a silica gel column chromatographic cleanup was necessary, recoveries of 97.3% were obtained from the column.

73-1995. Stickel, L. F.; Wiemeyer, S. N.; Blus, L. J. (U.S. Bureau Sport Fish. Wildlife, Patuxent Wildlife Res. Cent., Laurel, MD). **Pesticide residues in eggs of wild birds: adjustment for loss of moisture and lipid.** *Bull. Environ. Contam. Toxicol. 9(4): 193-196; 1973.* (7 references)

Valid interpretation of residue data for eggs of wild birds depends on compensation for losses in moisture and metabolism of fat that occur before analysis is made. This helps eliminate large differences in residues based on weight between fresh and nearly dry eggs. A method was devised for adjusting values based on the volume of the egg as measured by water displacement. Formulas were derived for estimating the volume of eggs of eagles, ospreys, and pelicans from the length and breadth of the egg. Although no calculations were done, the possibility of making adjustments based on stable parameters such as dry solids was suggested.

73-1996. Gunther, F. A.; Westlake, W. E.; Barkley, J. H.; Winterlin, W.; Langbehn, L. (Dept. Entomol., Univ. California, Riverside, CA 92502). **Establishing**

dislodgeable pesticide residues on leaf surfaces. *Bull. Environ. Contam. Toxicol. 9(4): 243-249; 1973.* (6 references)

A procedure was established for determining surface and penetrated residues of dioxathion, parathion, and phosphamidon on peach, citrus, and grape leaves; some field studies were carried out to determine the variability of individual samples and the credibility of total data obtained. Two types of leaf punches were made, one for thick xeromorphic leaves and one for thin mesomorphic leaves. Stripping was accomplished by shaking 40 2.5-cm citrus leaves or 200 1.8-cm grape or peach leaves twice with water containing a wetting agent and once with water, and extracting the residue into hexane. The stripped discs were shaken to remove water and blended with hexane or $CHCl_3$ to remove penetrated residues. Parathion residues on peach leaves after application of 1 lb. A.I./A of encapsulated parathion were 100 ppm initially, < 50 ppm by the 17th day, and did not decline significantly from day 17 to day 60. The same pattern was obtained for penetrated residues, which were about 40 ppm lower. Surface residues on orange leaves after application of five lb A.I./A of an emulsion concentrate formulation of dioxathion averaged 25 ppm initially, 40 ppm after about 13 days, and 1 ppm after 70 days. Penetrated residues, which were lower, followed the same pattern.

73-1997. Rodrigues, C.; Baldry, D. A. T. (Vet. Res. Lab., P.O. Kabete, Kenya). **A technique for the bioassay of insecticide deposits on leaf and bark samples in relation to tsetse control operations.** *Bull. WHO 47(6): 811-813; 1972.* (5 references)

During tsetse control operations it may be necessary to determine the effective toxicity and persistence of insecticide residues on vegetation. A simple method for preparing samples of twig bark for bioassay and an exposure apparatus that has been found very satisfactory for exposing tsetse flies to residues on leaves and bark are described. The apparatus is easily manipulated and involves little handling of the test material. (Author abstract by permission)

73-1998. Foster, R. K.; McKercher, R. B. (Dept. Soil Sci., Univ. Saskatchewan, Saskatoon, Saskatchewan, Canada). **Extraction of ^{14}C-labelled chlorophenoxyacetic acids from soil.** *Can. J. Soil. Sci. 53: 135-136; 1973.* (5 references)

Five solvent systems and a number of extraction techniques were investigated for recovering ^{14}C-labeled 2,4-D, MCPA, and 2,4,5-T from Chernozemic soils. Benzene:2-propanol gave 86% recovery and good reproducibility. A double extraction using three hour and one hour shaking periods was the most efficient method. Acidification of the soil with H_3PO_4 was necessary, and freeze-drying the soil prior to extraction resulted in the best recoveries. The method was not examined for use by GC or other assay methods.

73-1999. Jonas, L. A.; Rehrmann, J. A. (Chem. Lab., Edgewood Arsenal, MD 21010). **The kinetics of adsorption of organo-phosphorus vapors from air mixtures by activated carbons.** *Carbon 10(6): 657-663; 1972.* (9 references)

Kinetic flow conditions were used to study the adsorption characteristics of activated carbons for sarin and dimethyl methylphosphonate (DMMP). At various bed weights the breakthrough time of the vapor through the bed was determined, using an exit concentration equivalent to 1% of the inlet concentration. The kinetic saturation capacity of the carbon for each vapor was also determined. Solving kinetic equations constructed for each vapor simultaneously indicated that the breakthrough time for sarin could be correlated with that of DMMP. The prediction of adsorption of one vapor based on prior characterization with a reference vapor can be extended for use under kinetic conditions. A method capable of predicting the capacity of an activated carbon for sarin from the experimental DMMP value within 4.1% is presented.

73-2000. Blazquez, C. H. (Univ of Florida, Agr. Res. Cent., Immokalee, FL 33934). **Residue determination of ethylenethiourea (2-imadazolidinethione) from tomato foliage, soil, and water.** *J. Agr. Food Chem. 21(3): 330-332; 1973.* (18 references)

A thin-layer chromatographic method was developed for the analysis of ethylenethiourea (ETU) (2-imidazolidinethione) from tomato foliage, soil, and water. High yields of ETU were obtained when heat was applied during the evaporation of dioxane-water suspensions of the fungicides ethylenethiuram monosulfide (ETM) and ethylenebisdithiocarbamate (Dithane M-45). Investigations indicated that no ETU was detected from Dithane M-45 applications on tomato foliage, soil surface, or ditch water. The TLC method had a sensitivity of 1 ppm, which is adequate in residue analysis experiments. ETU was detected as low as 1 ppm with the TLC method, a concentration adequate in field investigations of the degradation of ethylenebisdithiocarbamate fungicide residues and their biological activity. The TLC method coupled with a bioassay technique fit well into residue monitoring (RM) method of the EWDC system for more efficient timing of pesticide applications. (Author abstract reprinted by permission of the American Chemical Society)

73-2001. Kirkland, J. J.; Holt, R. F.; Pease, H. L. (E. I. du Pont de Nemours & Co., Biochem. Dept., Exp. Sta., Wilmington, DE 19898). **Determination of benomyl residues in soils and plant tissues by high-speed cation exchange liquid chromatography.** *J. Agr. Food Chem. 21(3): 368-369; 1973.* (8 references)

Benomyl [methyl 1-(butylcarbamoyl-2-benzimidazolecarbamate] residues in soils and plant tissues may be determined by procedures using high-speed cation

exchange liquid chromatography (lc). The method for soils is based on an acidic methanol extraction of the residues, which converts residual benomyl to MBC (methyl 2-benzimidazolecarbamate). After a liquid-liquid partitioning cleanup, the total benomyl and/or MBC residues are measured as MBC by high-speed liquid chromatography. Any 2-AB (2-aminobenzimidazole) present in the original sample is also extracted and simultaneously determined as a separate lc peak. Recoveries of benomyl, MBC, and 2-AB from various types of soils average 92, 88, and 71%, respectively. The lower limit of sensitivity of the method is 0.05 ppm for each of these components. The method for plant tissues is based on ethyl acetate extraction of the residue followed by liquid-liquid partitioning cleanup and liquid chromatographic measurement. Recoveries and limit of sensitivity of this method for plant tissues were essentially that found for soils. (Author abstract reprinted by permission of the American Chemical Society)

73-2002. Schulten, H. R.; Beckey, H. D.* (Inst. fuer Physikalische Chem. der Univ. Bonn, Bonn, Germany). **Field desorption mass spectrometry of pesticides and their metabolites.** *J. Agr. Food Chem. 21(3): 372-375; 1973.* (15 references)

The first application of low- and high-resolution field desorption mass spectrometry (fdms) to chlorinated pesticidal compounds of the dimethano-naphthalene and methano-indene types demonstrates the potential of the new analytical technique for the determination of the molecular weight of basic pesticides. The technique proves to be even better for their metabolites. Fdms enables positive identification of these compounds. The water elimination observed in the fd mass spectra of *cis*- and *trans*-aldrindiol can be used to distinguish between these stereoisomers, which is not possible with electron impact mass spectrometry(eims). (Author abstract reprinted by permission of the American Chemical Society)

73-2003. Williams, I. H.; Brown, M. J. (Canada Dept. of Agr., Vancouver 8, British Columbia, Canada). **Determination of carbofuran and 3-hydroxycarbofuran residues in small fruits.** *J. Agr. Food Chem. 21(3): 399-401; 1973.* (6 references)

A method is described for determining residues of carbofuran (2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate) and its 3-hydroxy metabolite in strawberries, raspberries, blueberries, and cranberries. The extraction method of Cook et al. (1969) was modified to include a dichloromethane extraction of the filtered solids. Cleanup was on a silica gel-alumina column with mixtures of dichloromethane-ether and acetone-methanol as eluents. Determination was by gas chromatography (gc) with nitrogen detection using a Coulson conductivity detector. Recoveries of both carbofuran and 3-hydroxycarbofuran from fortified samples averaged greater than 86% over the range 0.2 to 5.0 ppm. (Author abstract reprinted by permission of the American Chemical Society)

73-2004. Selim, S.; Seiber, J. N.* (Dept. of Environ. Toxicol., Univ. of California, Davis, CA 95616). **Gas chromatographic method for the analysis of metaldehyde in crop tissue.** *J. Agr. Food Chem. 21(3): 430-433; 1973.* (8 references)

A simple and sensitive gas chromatographic method is described for the analysis of residues of the molluscicide metaldehyde in crop tissue. After extraction with benzene and cleanup on Florisil, metaldehyde was converted to acetaldehyde, which was determined as its 2,4-dinitro-phenylhydrazone derivative using alkali-flame ionization gas chromatography. Recoveries of 94 to 102% were obtained for artichoke and strawberry samples fortified at 0.1, 1.0, and 10 ppm. Acetaldehyde as well as other aldehydes and ketones may be determined separately by the same derivatization procedure through analysis of the sodium bisulfite extract of the benzene solution. (Author abstract reprinted by permission of the American Chemical Society)

73-2005. Buelow, R. W.; Carswell, J. K.; Symons, J. M. (Standards Attainment Branch, Water Supply Res. Lab., Nat. Environ. Res. Cent., Office Res. Monitor., Environ. Protect. Agency, Cincinnati, OH). **An improved method for determining organics by activated carbon adsorption and solvent extraction—Part II (test method).** *J. Amer. Water Works Ass. 65(3): 195-199; 1973.* (8 references)

A general gravimetric adsorption-extraction method has been developed for determining low concentrations of organic contaminants, including pesticides, dissolved in water. Sample water was directed into an activated carbon column, and at the end of a sample run, carbon was dried and extracted with chloroform and then 95% ethyl alcohol. Extracts were evaporated to dryness and the weight of the residues was determined. Extracts could be processed for identification of components.

73-2006. Bontoyan, W. R.; Jung, P. D. (Pesticides Regulations Div., Environ. Protect. Agency, Beltsville, MD 20705). **Thin-layer chromatographic detection of chlorinated hydrocarbons as cross-contaminants in pesticide formulations.** *J. Ass. Offic. Anal. Chem. 55(4): 851-856; 1972.* (17 references)

Chlorinated pesticide contamination studies are reported in which a TLC method is used to analyze a variety of dust and liquid formulations. Eight g samples are extracted with 20 ml acetone, followed by elution with *n*-hexane on silver nitrate-aluminum oxide G TLC plates. This paper reports the results of a four year study, using a large collaborative sampling, in which the

detection limits and utility of the described procedure were examined. The method has been adopted as official first action for the detection of contamination by 0.01% aldrin, dieldrin, endrin, and technical DDT and by 0.05-0.10% chlordane, Strobane, and toxaphene. (Author abstract by permission)

73-2007. Meinen, V. J.; Kassera, D. C. (McLaughlin Gormley King Co., Minneapolis, MN 55414). **Collaborative study of a gas-liquid chromatographic determination of *d-trans*-allethrin.** *J. Ass. Offic. Anal. Chem. 56(3): 562-566; 1973.* (4 references)

A gas-liquid chromatographic (GLC) method for the quantitative determination of *d-trans*-allethrin in technical materials and formulations was collaboratively studied. The samples are diluted with acetone and analyzed by GLC, using a flame ionization detector and a 5% OV-1 GLC column. A statistical evaluation of the matched pair technical samples shows an overall coefficient of variation 0.31% and a coefficient of random error of 0.49%. An evaluation of the *F*-factor reveals no indication of systematic error contributions. A statistical evaluation of the results for 2*d-trans*-allethrin formulations showed coefficients of variation of 4.98 and 1.98. An examination of the *t*-values revealed a small contribution to systematic error. The somewhat high results of sample C are believed to be a result of lower quality GLC resolution. The addition of a requirement for minimum GLC column performance to the method should increase the overall quality of the GLC resolution. The method has been adopted as official first action. (Author abstract by permission)

73-2008. Hambleton, L. G. (Dept. of Biochem., Purdue Univ., W. Lafayette, IN 47907). **Collaborative study of the ultraviolet spectrophotometric and gas-liquid chromatographic methods for the determination of trifluralin and benefin in formulations.** *J. Ass. Offic. Anal. Chem. 56(3): 567-571; 1973.* (4 references)

Fourteen collaborators participated in a study of an ultraviolet (UV) spectrophotometric and a gas-liquid (GLC) method for the determination of trifluralin and benefin. In the UV method trifluralin or benefin is extracted from the solid carrier or dissolved in *n*-hexane, if the formulation is liquid, purified by chromatography on Florisil, and determined by UV spectrometry at 376 nm. In the GLC method the compound is extracted from the solid carrier or dissolved in acetone, if liquid, and determined by flame ionization GLC, using a column containing 5% DC-200 on 80-100 mesh Chromosorb W (HP). A statistical evaluation of the data by the technique of closely matched pairs is presented. The data shows good correlation between the two methods, and the methods seem to be reasonably accurate and precise. The ultraviolet and gas chromatographic methods have been adopted as official first action. (Author abstract by permission)

73-2009. McDermott, W. H. (Res. and Develop. Dept., Union Carbide Corp., P. O. Box 8361, South Charleston, WV 25303). **Infrared analysis of carbaryl insecticide: modification of the extraction procedure to accommodate liquid suspension formulations.** *J. Ass. Offic. Anal. Chem. 56(3): 576-578; 1973.* (4 references)

The extraction procedure for the official first action infrared analysis for carbaryl in formulations, 6.206-6.208, has been modified by the addition of anhydrous granular sodium sulfate to make the method applicable to liquid suspension formulations of carbaryl. A limited collaborative study of the modified method yielded a standard deviation of ±1% at the 40% level and a coefficient of variation of ±2%. The modification has been adopted as official first action. (Author abstract by permission)

73-2010. Wayne, R. S. (American Cyanamid Co., P.O. Box 400, Princeton, NJ 08540). **Collaborative study of the nonaqueous copper colorimetric and silver titrimetric methods for the determination of malathion in technical grade malathion and malathion formulations.** *J. Ass. Offic. Anal. Chem. 56(3): 579-585; 1973.* (8 references)

The nonaqueous copper colorimetric and the silver titrimetric methods for the determination of malathion were studied collaboratively. The study involved wettable powders, emulsifiable concentrates, dusts, and the technical grade product. The mean of all of the results indicates that both procedures will give comparable values for each sample type used in the study. Agreement between replicates in individual laboratories was excellent. Agreement between laboratories was satisfactory; coefficients of variation ranged from 1.3 to 4.8% for the samples studied. The two methods offer improved reliability and ease of operation when compared to the official first action colorimetric method, 6.265-6.269. The methods have been adopted as official first action. (Author abstract by permission)

73-2011. Hofberg, A. H.; Murphy, R. T. (Agr. Div., Ciba-Geigy Corp., Ardsley, NY 10502). **Collaborative study of a gas-liquid chromatographic method for the analysis of ametryne, prometone, and terbutryn.** *J. Ass. Offic. Anal. Chem. 56(3): 586-590; 1973.* (6 references)

A gas chromatographic method for the determination of ametryne and terbutryn in wettable powder formulations containing about 80% active ingredient and prometone in liquid formulations containing about 25% active ingredient was collaboratively studied, using a matched pair scheme. The ametryne was extracted from the powder with chloroform containing dieldrin as an internal standard and chromatographed on Carbowax 20M, using a flame ionization detector; the same method was used for terbutryn. The sample containing prometone was dissolved in chloroform containing dieldrin and chromatographed in the same manner. Two samples

of each pesticide were analyzed, using peak height measurements, with the following results: ametryne (14 collaborators)–1.63% overall coefficient of variation, 0.68% coefficient of variation for the random error, and 1.05% systematic error; prometone (15 collaborators)–2.27, 1.47, and 1.21%; and terbutryn (15 collaborators)–0.95, 0.51, and 0.56%, respectively. The method has been adopted as official first action. (Author abstract by permission)

73-2012. Malina, M. A. (Velsicol Chem. Corp., Chicago, IL 60611). **Collaborative study of methods for the analysis and control of AG-chlordane and its formulations.** *J. Ass. Offic. Anal. Chem. 56(3): 591-595; 1973.* (15 references)

Four methods for the analysis of AG-chlordane and its formulations were submitted to a collaborative study. Fifteen laboratories, including 5 CIPAC laboratories, participated in this study. The infrared method for the analysis of the content of the two chlordane isomers was precise, with a coefficient of variation of 0.015. The gas chromatographic method for the analysis of the heptachlor content also yielded good precision with a standard deviation of 0.16. The infrared assay method for granular formulations exhibited excellent accuracy and precision, with a coefficient of variation of 0.067 and an error of only +0.25% relative. The gas chromatographic assay method for emulsifiable concentrates exhibited poor accuracy and precision and was found unacceptable. The first three methods have been adopted as official first action. (Author abstract by permission)

73-2013. Holden, E. R. (Agr. Res. Serv., U.S. Dept. of Agr., Beltsville, MD 20705). **Gas chromatographic determination of residues of methylcarbamate insecticides in crops as their 2,4-dinitrophenyl ether derivatives.** *J. Ass. Offic. Anal. Chem. 56(3): 713-717; 1973.* (3 references)

A general procedure was developed for determining methylcarbamates in plant materials. The residue is extracted from crop material with acetonitrile, and the extractive is purified by partitioning with petroleum ether and coagulating with phosphoric acid-ammonium chloride solution. Phenolic impurities are largely eliminated by partitioning a methylene chloride extract with 0.1*N*-potassium hydroxide. Carbamate residues are then treated with 1-fluoro-2,4-dinitrobenzene to form the ether derivatives without a prior hydrolysis step. Efficiency in the conversion of the phenolic moieties to the phenyl ethers is essentially 100%, thus providing for good reproducibility. Residues may be determined at levels as low as 0.05 ppm. Recoveries generally range between 90 and 100%. (Author abstract by permission)

73-2014. Ang, C. Y. W.; Dugan, Jr., L. R.* (Dept. of Food Sci. and Human Nutr., Michigan State Univ., East Lansing, MI 48823). **Factors relating to completeness of solvent extraction of dieldrin from milk.** *J. Ass. Offic. Anal. Chem. 56(3): 718-720; 1973.* (6 references)

Milk containing added dieldrin was separated into 20 lipid fractions by differential solvent extraction. Fraction 1 was extracted with nonpolar hydrocarbon solvents and Fraction 2 with the same solvent system after mixing with sodium oxalate and ethanol. Three solvent systems were compared. Dieldrin concentrations in Fraction 1 of all three solvent systems were much higher than in Fraction 2 on a fat basis. Less than 50% of the dieldrin was recovered in Fraction 1, probably because of the low recovery of hydrocarbon solvents from fluid milk or factors that depressed the separation of solvents from milk. Factors possibly involved were the adsorption of solvents and pesticide to the hydrophobic groups of membrane proteins and/or serum proteins or the penetration of solvents and pesticide into fat globules of milk. (Author abstract by permission)

73-2015. Krause, R. T. (Food and Drug Admin., Minneapolis, MN 55401). **Determination of several chlorinated pesticides by the AOAC multiresidue method with additional quantitation of perthane after dehydrochlorination: collaborative study.** *J. Ass. Offic. Anal. Chem. 56(3): 721-727; 1973.* (10 references)

The AOAC multiresidue method for chlorinated pesticides, 29.0001-29.017, was studied collaboratively by seven laboratories. Perthane, heptachlor epoxide, mirex, and dieldrin were determined in apple and cauliflower samples fortified at two levels, and Perthane was determined in butterfat samples fortified at two levels. Perthane was quantitatively measured before and after a simplified dehydrochlorination procedure. Average recoveries and coefficients of variations for pesticides in the apple samples for both levels were: Perthane 100 ± 10%, heptachlor epoxide 102 ± 14%, mirex 96 ± 9%, dieldrin 101 ± 14%, and Perthane (after dehydrochlorination and recalculation to the parent compound) 100 ± 9%. Average recoveries and coefficients of variation for pesticides in the cauliflower samples for both levels were: Perthane 105 ± 9%, heptachlor epoxide 103 ± 15%, mirex 103±7%, dieldrin 98±11%, and Perthane (after dehydrochlorination and recalculation) 100 ± 10%. The average recovery for both levels of Perthane (after dehydrochlorination and recalculation) in the butterfat samples was 91 ± 10%. For a spinach sample with field-incurred residues the collaborators found an average of 4.47 ppm Perthane before dehydrochlorination and 5.09 ppm Perthane as the olefin after dehydrochlorination. In most instances, the identities of all the residues were confirmed by TLC. The dehydrochlorination technique has been adopted as official first action. (Author abstract by permission)

73-2016. Nash, R. G.; Harris, W. G.; Ensor, P. D.; Woolson, E. A. (Agr. Environ. Qual. Inst., Agr. Res.

Serv., U. S. Dept. of Agr., Beltsville, MD 20705). **Comparative extraction of chlorinated hydrocarbon insecticides from soils 20 years after treatment.** *J. Ass. Offic. Anal. Chem. 56(3): 728-732; 1973.* (14 references)

Three methods, shake, Soxhlet, and column, were compared for efficiency of extraction of certain chlorinated hydrocarbon insecticides from a Congaree sandy loam soil which had been treated 20 years earlier. Column extraction had a tendency to be less efficient than the other two methods, but statistically there were no differences in extraction efficiencies among the three methods for aldrin, dieldrin, heptachlor, chlordane, isodrin, endrin, toxaphene, or Dilan and their residue products. However, shake extraction was significantly more efficient for the BHC isomers than Soxhlet extraction and the latter was significantly more efficient than column extraction. (Author abstract by permission)

73-2017. Porter, M. L.; Burke, J. A. (Div. of Chem. and Physics, Food and Drug Admin., Washington, DC 20204). **An isolation and cleanup procedure for low levels of organochlorine pesticide residues in fats and oils.** *J. Ass. Offic. Anal. Chem. 56(3): 733-738; 1973.* (9 references)

An isolation and cleanup is described for low levels of organochlorine residues (about 0.005 ppm) in fats and oils, prior to electron capture gas-liquid chromatography. The fat or oil is distributed on a column of unactivated Florisil and the residues are partitioned into an eluant of 10% water in acetonitrile. Florisil column chromatography with an elution solvent system comprised of mixtures of methylene choride, acetonitrile, and hexane is used for the final cleanup. Extracts prepared in this manner are sufficiently free of fatty extractives to permit injection of the equivalent of 50-60 mg fat sample for GLC. The procedure should be especially useful in determination of low levels of organochlorine pesticide residues in the fat of certain dietary composites. (Author abstract by permission)

73-2018. Gordon, A. E.; Frigerio, A. (Ist. Ric. Farmacol. Mario Negri, Milan, Italy). **Mass fragmentography as an application of gas-liquid chromatography-mass spectrometry in biological research.** *J. Chromatogr. 73: 401-417; 1972.* (48 references)

Mass spectrometry, the separation of charged particles or ions of different masses under an applied magnetic field, is widely used in organic chemistry for identification of specific materials. Mass fragmentography focuses on one or a few fragment ions rather than the total ion spectrum. Gas-liquid chromatography is the chromatographic separation method most easily coupled directly to the mass spectrometer. In SID (single-ion detection) the mass spectrometer is used as a specific GLC detector. Only one mass fragment is focused, and the sensitivity of GLC is increased 100-10,000 times over other detection methods. Examples of pesticides and pollutants investigated by mass fragmentometry include SID detection with a sensitivity of 500 pg using a quadrupole spectrometer; detection of DDT with a sensitivity of 10 pg; and detection of mercury and lead in the ng range.

73-2019. Eastin, E. F. (Dept. of Soil and Crop Sci., Texas A & M Univ., College Station, TX 77843). **Separation of bentazon and some related compounds by thin-layer chromatography.** *J. Chromatogr. 76: 272-273; 1973.*

Bentazon (BAS-351, 3-isopropyl-1*H*-2,1,3-benzothiadiazine-(4)- 3*H*-one-2,2-dioxide) is a new herbicide for weed control in soybeans, peanuts, rice, and other crops. Optimum separation of bentazon and two of its probable degradation products was attained by thin-layer chromatography on a commercially prepared TLC sheet, developed with methanol-ethyl acetate (1:4). The compounds were detected as blue spots on a white background when the developed sheet was exposed to UV radiation at 254 nm. The lower limit of detection for these compounds under the test conditions was between 0.5 and 0.1 μg.

73-2020. Beernaert, H. (Inst. of Hyg. and Epidemiol., Food Sect., Brussels, Belgium). **Determination of biphenyl and orthophenylphenol in citrus fruits by gas chromatography.** *J. Chromatogr. 77(2): 331-338; 1973.* (25 references)

A new gas chromatographic method has been developed for the rapid and accurate identification and determination of biphenyl and orthophenylphenol in citrus fruits. Several illustrations are given of standard curves and recoveries. A check on overlapping components has been carried out by using a combination of gas chromatography and mass spectrometry. The analytical results on eighteen samples of citrus fruits are tabulated. (Author abstract by permission)

73-2021. Wolfenbarger, D. A.; Shaver, T. N. (Agr. Res. Serv., U.S. Dept. of Agr., Brownsville, TX 78520). **An infrared spectrophotometric technique for determining residues of several organo-phosphorus insecticides from cotton foliage.** *J. Econ. Entomol. 66(2): 332-336; 1973.* (11 references)

Infrared spectra of azinphosmethyl, azinphosmethyl oxon, EPN, EPN oxon, malathion, malaoxon, fenitrothion, and fenitrothion oxon were compared for dissimilarities from 1300 to 400 cm^{-1}. Recoveries of azinphosmethyl, EPN, and fenitrothion from cotton-leaf homogenates by P=S absorbances ranged from 71 to 97%; recoveries from leaf washes ranged from 44 to 90%. Residues of malathion by P=S 655 cm^{-1} absorbance and scale expansion showed a regression of Y (log ppm) = 8.89-0.49 X (X = days) from the time of application. (Author abstract by permission)

73-2022. Lyalikov, Y. S.; Kitovskaya, M. I. (Anal. Chem. Lab., Chem. Inst. Acad. Sci. Moldavian SSR, Kishinev, USSR). **A thermogravimetric study of some dithiocarbamate fungicides.** *J. Therm. Anal. 4(3): 271-280; 1972.* (10 references)

A quantitative thermogravimetric method for determining all ethylene-bis-dithiocarbamates was demonstrated through an investigation of a series of dithiocarbamate-based fungicides (ziram, ferbam, Thiram, and polycarbazine) which indicated that differences in their thermal decompositions were a result of differences in structure. Organic material burned off completely at 270 to 320° and in the case of metal-containing compounds, sulfides remained. The step-wise thermal decomposition of the type found with Zineb is probably connected with the cyclic structure since decomposition of this type differed from that of dimethyldithiocarbamates and monovalent metal ethylene-bis-dithiocarbamates. The temperature at which reactions started was specific for the salt-forming metal present, and weight loss was proportional to the amount of thermoactive material present. The procedure eliminates the need to isolate the active ingredient to be determined, even though knowledge of the composition and possession of reference curves for constituents may be lacking. In laboratories where there is no thermogravimetric equipment the same procedure can be used by measuring evolved carbon disulfide.

73-2023. Skrinde, R. T. (Reynolds, Smith and Hill, Jacksonville, FL). **Organics.** *J. Water Pollut. Contr. Fed. 44(6): 911-915; 1972.* (59 references)

A review of methods for determining organic water pollutants outlines some of the recent advances in pesticide analysis. References are given for a colorimetric field test and more sensitive laboratory tests for organophosphates, determination of hexachlorocyclohexane (BHC) in water and soil, detection of gramoxone (paraquat), and GC analysis of organochlorines and organophosphates. Use of some of these methods has given information about the toxic levels of the compounds to aquatic organisms.

73-2024. Kutuzov, G. P.; Chernyayev, N. G. (All-Union Sci. Res. Inst. Animal Feed, Moscow, USSR). **Opredeleniye semerona v rasteniyakh i pochve metodom khromatografii v tonkom sloye. [Determination of semeron in plants and in the soil by thin-layer chromatography.]** *Khim. Sel. Khoz. 9(11): 849-850; 1971.* (6 references) (Russian)

A TL chromatographic method for determination of semeron (desmetryne, 2-methylthio-4-methylamino-6-isopropylamino-sym-triazine) residues in plant and soil samples is described. After extraction from soil samples with diethyl ether and from plant samples with hexane, the purified extract is dissolved in a 7:3 or 8:1 solvent system of hexane and acetone, or in a 12:3:3 solvent system of cyclohexane, benzene, and acetic acid. Visualization is done by means of bromophenol reagent. The sensitivity of the method is 1 μg/kg. The rates of recovery from plants and soil are 82-92% and greater than 90%, respectively.

73-2025. Tewari, S. N.; Harplani, S. P. (Toxicol. Div., Chemical Examiner's Lab., Agra, India). **Detection of organo-phosphorus pesticide residues in autopsy tissues by thin-layer chromatography.** *Mikrochim. Acta (Wien) 1973: 321-324; 1973.* (23 references)

A procedure was developed for extracting organophosphorus pesticides from postmortem tissues and separating and identifying them by TLC. Liver tissue was macerated with acetone and anhydrous sodium sulfate. A filtrate of the mixture was evaporated to dryness and the residue was taken up in hexane and partitioned with acetonitrile. The acetonitrile was evaporated and the residue, taken up in ethanol, was spotted on Silica Gel-G plates. Benzene was the best solvent for separation of parathion, methyl parathion, malathion, diazinon, and meta-systox (methyl demeton). Metabolites of malathion and meta-systox were separated best by cyclohexane:actetone and cyclohexane:ethyl methyl ketone, respectively. Plates were sprayed with a 0.5% alcoholic solution of Rhodamine B, dried and exposed to bromine vapor, and yielded deep pink to violet spots.

73-2026. Romminger, K.; Kubel, D. (Zentrale lebensmittelhygienische Untersuchungsstelle, Berlin-Weissensee, DDR). **Methode zur qualitativen und semiquantitativen duennschichtchromatographischen Bestimmung 9 verschiedener chlororganischer Pflanzenschutz- und Schaedlingsbekaempfungsmittel sowie des DDE in Fetten und fetthaltiger Kinderfertignahrung. [Method for qualitative and semiquantitative thin-layer chromatographic determination of 9 different organochlorine herbicides and pesticides as well as of DDE in fats and fat-containing baby food.]** *Nahrung 16(7): 801-803; 1972.* (German)

A thin-layer chromatographic method for the qualitative and semiquantitative determination of lindane, DDT, DDE, thiodan (endosulfan), heptachlor epoxide, heptachlor, endrin, dieldrin, aldrin, methoxychlor, and dicofol in fats and in fat-containing baby foods is described. Fats previously melted for partial dehydration, oils, and chloroform extracts of baby foods are dissolved in *n*-hexane. The resulting *n*-hexane solutions are shaken with acetonitrile, and the acetonitrile extracts are evaporated. The extracts are purified on silica gel and alumina with 12% of water, and the eluate is dissolved in *n*-hexane. The thin-layer chromatographic residue determination is done by visual comparison of chromatographic spots.

See also **73-1814** **73-1837** **73-1849** **73-1867**

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